S. HRG. 113–169

BRIDGING THE SKILLS GAP: HOW THE STEM EDUCATION PIPELINE CAN DEVELOP A HIGH-SKILLED AMERICAN WORKFORCE FOR SMALL BUSINESS

ROUNDTABLE

BEFORE THE

COMMITTEE ON SMALL BUSINESS AND ENTREPRENEURSHIP
UNITED STATES SENATE

ONE HUNDRED THIRTEENTH CONGRESS

FIRST SESSION

MAY 22, 2013

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BRIDGING THE SKILLS GAP: HOW THE STEM EDUCATION PIPELINE CAN DEVELOP A HIGH-SKILLED AMERICAN WORKFORCE FOR SMALL BUSINESS

WEDNESDAY, MAY 22, 2013

UNITED STATES SENATE,
COMMITTEE ON SMALL BUSINESS
AND ENTREPRENEURSHIP,
Washington, DC.

The Committee met, pursuant to notice, at 10:08 a.m., in Room 428, Russell Senate Office Building, Hon. Mary L. Landrieu (chair of the committee) presiding

Present: Senators Landrieu, Pryor, Shaheen, and Risch.

OPENING STATEMENT OF HON. MARY L. LANDRIEU, CHAIR, AND A U.S. SENATOR FROM LOUISIANA

Chair LANDRIEU. Good morning. Our Small Business Roundtable will come to order. We are expecting a couple of our members to join for a hopefully informative and informal hour-and-a-half to two-hour discussion about a very important matter pending before the Congress, and that is, Bridging the Skills Gap, How Stem Education Pipeline Can Develop a Higher Skilled American Workforce for Small Businesses.

There is a lot of focus in my view on what large businesses may need, GE, IBM, et cetera, but not enough in this discussion on immigration reform, in my view, about what the critical skill gaps are with small businesses, 10, 25, 50, 100 employees; start up businesses; and is the immigration bill that passed the Committee just last night, which in my view was the right step forward. I am generally supportive of comprehensive immigration reform.

But we are going to explore today, I am sure you all are familiar with what is in that bill as we have been following it closely to see how it affects the small business skills gap issue.

So, thank you for joining us at the Roundtable. As I stated, the purpose is to discuss challenges faced by startups and small- and medium-size business relative to workforce training and readiness.

It will cover America's need to bridge the current workforce skill gap and fuel small business growth through the development of a sustainable STEM education pipeline.

The central question I want to ask to you all today: What are the skills that workers and potential employees of small businesses need to meet the demands of small business owners and how can we make sure that all Americans, including women and minorities,

develop the skills necessary to be hired and meet the opportunities for growth and expansion of many small businesses in America that have, indeed, a very promising future?

We have assembled here today an impressive group of policy experts and small business owners to help us explore the answer to this question. So, thank you all for being with us today.

This is the second in a series of roundtables that will focus on the specific immigration reform issues that are in the major piece of legislation that are affecting small business.

We will share these ideas, comments, questions, and solutions that have come from our roundtable with the cosponsors of the bill and some of these ideas may turn into amendments on the floor of the Senate or the House.

As you have all heard, S. 744 passed out of Judiciary last evening with a vote of 13 to 5. Last week in this Committee, in this room, we had a spirited and informative discussion about the ramifications of the E-Verify program on small businesses as proposed by S. 744, The Border Security Economic Opportunity and Immigration Modernization Act of 2013.

In a few weeks, we will hold our third and final roundtable on immigration that looks at innovative border security technologies, what portal is DHS using to open up opportunities for small businesses in America that have the technology currently available to help secure our borders and bring more transparency to the process of government contracting.

The American Society for Training and Development defines the skills gap as a significant gap between the organization's current capacity and skills it needs to achieve its goals.

It is the point at which an organization can no longer grow or remain competitive because it can not fill the critical jobs with employees who have the right knowledge, skill set, and abilities.

According to the latest data from the Bureau of Labor Statistics, the U.S. currently has 3.7 million job openings waiting to be filled. I believe that most people, at least the people that I represent, want to work and many businesses want to hire but the widening skill gap prevents many Americans from filling the jobs of the 21st century and from our exciting small businesses from expanding.

According to the International Center for Leadership in Education, the skills gap in the country has resulted from a shift in our economy that is becoming increasingly supported by STEM-based industries and occupations, science, technology, engineering, and math.

These occupations include computer software engineers, network and database administrators, physician assistants, and home health aides. It seems to me that software engineers, network and database administrators, and physician assistants, and home health care aides could be trained in the domestic workforce right here in America, although there is a big push to open up opportunities for foreign workers to come in for these and other jobs.

Additionally, according to a recent report by the Congressional Research Service, jobs in many occupations even non-STEM occupations require a high level of STEM knowledge than ever before. Students who pursue STEM-based education programs gain thinking, problem-solving skills that will enable them to be successful.

Most significantly a large percentage of the workforce in industries and occupations that rely on STEM knowledge and skills are technicians and others who enter and advanced in fields associated with degrees and certificates through the workplace training.

According to Wells Fargo Gallup Small Business Index, even though half of small business owners hired new workers in 2010, 42 percent of these hired, fewer employees than needed.

That is a very interesting statistic. I want to repeat that. According to a Wells Fargo Gallup Small Business Index survey, even though half of small business owners in America hired new workers in 2010, 42 percent said they hired fewer than needed, I am assuming because they could not find the right skills.

Sixty-two percent of that group said it was because it was hard to find qualified employees for positions available.

A study by the National Research Council shows that small businesses employ nearly 40 percent of American scientists and engineers, produce four times more patents than larger businesses and universities and produced patents that are of higher quality and more than twice as likely to be cited. That is pretty exciting.

One part of the bill being debated by the Judiciary Committee would raise the number of H–1B visa recipients to a maximum of 180,000 from the current 65,000, nearly doubling the amount of foreign workers that U.S. businesses would be able to hire.

An additional 25,000 H–1B visas will be reserved for foreign students who have obtained advanced degrees in science, technology, and engineering.

While allowing these high-skilled foreign STEM graduates to stay, work, and grow businesses in the U.S. is something that I support, it is something that is already in the bill. It can most help us close the skill gap in the near term. I personally believe we must take the steps necessary to develop our own domestic workforce to meet the continued needs of U.S. business in the decades to come. That is what this panel is about.

Companies want to expand and hire additional employees. However, too few American workers have been given the opportunity for retraining, potentially too few students are graduating with STEM skills. Why is that happening when we are spending billions and billions of dollars of education in the United States?

For example, according to the Department of Commerce, minorities comprise only 28 percent of the overall STEM workforce; they represent 36 percent of the total workforce but only 28 percent of the STEM workforce.

Women make up 48 percent of the national workforce while they makeup just 24 percent of the STEM workforce or STEM workers. Furthermore in 2007, unrepresented minority groups comprise 33.2 percent of college-age population in the United States but only 17 percent of undergraduate students earned a STEM degree.

So, the work by the Judiciary Committee has been finalized but the work of the Senate has not. Our Committee hopes to provide some informed debate for the Senate floor on this issue.

Last week, the Senate Judiciary Committee adopted Senator Hatch's amendment that will add $1000 fee in addition to what was already in the bill for an H–1B petition. These new funds will be deposited in the STEM education and training account that will

raise an estimate of $135 million per year. Seventy percent of these funds will be distributed to states for STEM-related grants for the purpose of improving STEM education so that it meets the needs of both students and employers, and I would say employees that need retraining.

The National Science Foundation will receive 20 percent for STEM capacity building at minority-serving institutions of higher ed, and the remainder will be divided between the departments for job training and administrative costs. While this is a step in the right direction, the question is: Is it a big enough step to make a difference?

This new fund is in addition to the existing H–1B non-immigrant petitioner account that also uses H–1B visas to fund STEM scholarships. Together these funds will raise between $230 million and $300 million per year which sounds like a lot except I am going to figure out how much money we are spending per year in all of education. I think this will be a drop in the bucket.

While this is certainly a move in the right direction, I believe we can do more. I believe our country needs a more well trained domestic workforce as well as opening up opportunities for foreign workers to come in in the short term and help us fill the gap.

Are we as legislators doing enough to meet the needs of our small businesses? What exactly are those needs? What would small businesses like to see? That is going to be part of the roundtable today.

Before I ask you to introduce yourselves, I would like to go over the format. We have done this now successfully, I think, and we have gotten a lot of good feedback about our roundtables.

This is very informal. It is not like a regular hearing. I am going to ask each of you to introduce yourself and speak for less than one minute about your main theme or idea. Then, I am going to ask a series of questions that you all can respond to as you will.

You should just place your name card up like this with your name facing me so that I can call on you. Why do we not start to my left with Dr. Kolvoord to introduce yourself and give just kind of a one-minute thought or, you know, comment and then we will begin with questions.

Dr. KOLVOORD. Thank you, Senator Landrieu. My name is Bob Kolvoord. I am the Co-director of the Center for STEM Education and Outreach at James Madison University.

My interest here is in thinking through the possibilities in higher education to provide additional STEM opportunities for students beyond the traditional ones that we have offered for a long time.

Often higher education is somewhat slow to change, I think might be a charitable way to say it. We at James Madison have pioneered some interesting and innovative new programs to draw additional students to STEM majors and through to graduation. We have increased our STEM majors more than 25 percent in the last five years.

I would like to share details of the appeal of some of those programs to women and under-represented minorities.

Chair LANDRIEU. Well, we are very excited about that. Thank you very much and we look forward to getting some detail.

Dr. Ferrini-Mundy.

Ms. FERRINI-MUNDY. Good morning, Chair Landrieu.

Chair LANDRIEU. You have to speak into your mic and kind of lean into it like this because it is a little difficult but it will pull toward you.

Ms. FERRINI-MUNDY. Good morning and good morning roundtable participants and distinguished guests.

My name is Joan Ferrini-Mundy, and I am the Assistant Director at the National Science Foundation for the Education and Human Resources Directorate, and I am very pleased to be here today.

At the National Science Foundation, we engage, through competitive merit review processes, in funding projects of a range of types that are intended to support STEM education and workforce development.

So particularly, I would like to highlight our advanced technological education program as one example of a strategy that the NSF has used to encourage partnerships among institutions of higher education, mostly community colleges in this case, with local industry and business to develop preparation programs for technicians and technology experts who can really be well prepared to move into those business settings quickly.

And so, we feel that that kind of a strategy together with funding more research about what it takes to be well prepared for business and how to close the skills gap of which you spoke are important ways for the Federal Government to support the improvement of preparation in the workforce.

Chair LANDRIEU. Wonderful.

And I cannot see your name card. I am sorry. Okay. Mr. Uvin.

Mr. UVIN. Good morning, Chair Landrieu. I am Johan Uvin. I am a Deputy Assistant Secretary at the U.S. Department of Education and I coordinate our policy issues in the Office of Vocational and Adult Education, focusing on adult education, career——

Chair LANDRIEU. Is your button pressed? I am sorry. Press the talk button.

Mr. UVIN. I coordinate our policy issues around adult education, secondary and post-secondary career and technical education, which has a great STEM focus in it and our community college work.

In my opening remarks I want to draw attention to the fact that the Administration is proposing a comprehensive reorganization of STEM education programs to support a cohesive national STEM educational strategy and to increase the impact of federal investments in the 2014 budget proposals to consolidate or restructure more than half of the 226 STEM programs and redirect the funding to four priority areas, pre-kindergarten through grade 12 instruction, undergraduate education, graduate fellowships, and informal education activities.

We have a handout for everyone, and we would be more than happy——

Chair LANDRIEU. That would be wonderful if the staff could pass that around and people can glance at it as they are here.

I am very proud and aware and proud of the Administration's efforts to consolidate and streamline and really meet the challenge of a domestic workforce that is probably not having as much oppor-

tunity as could be provided if the government and our private sector partners would restructure themselves appropriately.

So, thank you. We look forward to getting into some detail.

The Ranking Member has just arrived. I would like to go ahead and have everybody finish introducing themselves and then we will recognize the Ranking Member for opening comments.

Ms. McAdams.

Ms. MCADAMS. Good morning, and thank you very much for having us here and also for the leadership that you have shown on this issue.

I am familiar with many of the STEM focused schools and STEM efforts in your State and in the States of other members of this Committee, and I am coming to you as a Senior Adviser on STEM Education at the U.S. Department of Education and also as a former educator. I taught math and science in urban public schools for 10 years and was also the STEM District Administrator as well here in the District of Columbia.

So, the perspective that I bring also comes from what teachers and students are doing that is working and also what we need more of and I think what we need the most of is partnerships and more people helping to bridge academic achievement gaps but also skills gaps.

I am happy to answer questions about our proposals, not only in the fiscal year 2014 budget but also current investments that the Department of Education has made to help improve STEM education both at the P through 12 level and in our higher education space.

Thank you very much.

Chair LANDRIEU. Wonderful.

Ms. Fiala.

Ms. FIALA. Good morning. Thank you, Chair Landrieu.

Chair LANDRIEU. Press your button and speak into your mic.

Would the staff please be of assistance?

Ms. FIALA. Can you hear me now?

Chair LANDRIEU. Yes. Pull the mic a little bit closer to you. There you go.

Ms. FIALA. Thank you, Chairman Landrieu, and thank you Ranking Member Risch. We are very pleased to be here today to talk about the work that we are doing at the Department of Labor to meet the skill needs of America's small businesses, and particularly we know that you are interested in the job training funds that we funded through our share of H–1B revenue fees paid by employers.

So I want to talk about those a bit. I want to talk about the partnerships. I think that is terribly important, which was emphasized between employers and the training organizations to define what is needed by small business.

Our long-term goal in this effort is to decrease the need for H–1B visas by helping American workers develop the high skills that they need to meet the requisite requirements, skill requirements of America's employers.

Chair LANDRIEU. Thank you. Very interested in that. While I am very open to foreign workers coming in and I can absolutely agree the statistics are clear that we need to fill this gap in the near future, I think every American would like us to do more to develop

our own workforce here at home and give people opportunities here at home. I am glad to know you are focused on that.

Ms. Belsky.

Ms. BELSKY. Thank you for having us here today. I am here representing an organization called Engine Advocacy, which represents hundreds of startups throughout the U.S., and I myself am an executive at a startup company called Kaltura.

We are a 200-person company that grew from about 15 over the past few years. We are headquartered in New York with R and D centers in Israel, and we were founded by four immigrants.

So, there is a lot I can share just from on the ground experience, both from our own business but also from working with the network of startups at Engine, and I am on their board of advisors.

Chair LANDRIEU. Thank you.

Ms. Mooney.

Ms. MOONEY. Yes. Hello. Thank you for having me here today. I represent a company called Micron. We manufacture memory in virtually all of our electronic products. I am actually from the Micron Foundation.

Our mission is to support math and science education programs. So, I am very interested in the conversation here today. We believe in three areas, supporting our teachers, supporting our students and our community. Those public-private partnerships are where we need to come together to increase the STEM pipeline.

Thank you.

Chair LANDRIEU. Thank you very much.

Mr. Goodman.

Mr. GOODMAN. Hello. Thank you very much for having me here and giving me an opportunity to speak. My name is Loren Goodman. I am the Chief Technology Officer for a software company in Chicago, and we have two problems.

One is a deficit of finding talent which has put us in a difficult situation; and on another level, I really think to approach the STEM problem we need to make programming literacy on par with the time tables in our education system, that there is a common denominator of all of these which is the ability to make technology do what you want, and we are not baking it into kids on a par with the other things that we teach them.

I think an entire country or people who can program and make a computer do anything will be far better prepared to compete with other countries as we go forward.

Chair LANDRIEU. Thank you, Mr. Goodman.

Ms. MONEYPENNY. An appropriate name for this Committee.

[Laughter.]

That is right. I know.

Chair LANDRIEU. But money dollars would be better but go right.

Ms. MONEYPENNY. I am sorry. I will change my name to that.

I really do appreciate the opportunity to be here. I am Naomi Moneypenny. I am the Chief Technology Officer at ManyWorlds. We are a small software company out of Houston, Texas.

What we are really focused on is having that workforce available to us. We are struggling currently finding the talent that we need, and the talent that we can get actually we are competing against much, much larger firms to get. So, we have had to resort to, you

know, importing some of that talent, even off-shoring some of the jobs that we need.

Another focus for us just because you had it in your opening comments is actually around the patent process. About 20 percent of our revenues go to research and development, primary research and development.

So, patenting is a very important process for. We have over 15 granted patents already and another 25 or so in the works.

So, finding the workforce, those specific skills that we really need and how do we drive those into the education system so that, as Loren was saying, we can adapt and move quickly and maintain American competitiveness.

Chair LANDRIEU. Thank you very much.

Dr. Taylor.

Ms. TAYLOR. Good morning. Thank you for the invitation to be here. I am Shree Taylor. I am the cofounder and managing partner of Delta Decisions of DC.

We are a small business that focuses on the use of data to solve a broad range of problems for organizations and businesses as well in the federal, state, and sectors.

I am interested in developing solutions and also partnerships to help demystify, expose, and mentor our STEM students. My bachelors, Masters, and PhD are all in applied mathematics. So, it is very possible to have homegrown talent here. I graduated from Clark-Atlanta University in Atlanta, Georgia, which is an HBCU. My PhD is from North Carolina State University.

Chair LANDRIEU. Ms. Wang.

Ms. WANG. Thank you, Senator, and thank you for the Committee for inviting me to be here. I am here as a member of WIPP, Women Impacting Public Policy, as well as CEO of my own firm, Binary Group. We are a government technology consulting firm providing technology solutions to the Department of Defense.

What I want to talk about here are two things. One is we cannot find enough cleared skilled engineers to hire. We have opened billets that we cannot fill because there are just not people out there ready to be hired. That is one issue.

The other one is one of my passions. I am actually an immigrant and he came here on a bill that was that in 1990, Chinese Students Protections Act. I am passionate about STEM because my background is computer science. I think we can do a lot more here in this country to build a skilled bench for the U.S. economy by encouraging young girls and boys, starting with math and science education early. That is what my personal belief is that that education has to start very early.

Chair LANDRIEU. Thank you so very much.

Ranking Member Risch.

OPENING STATEMENT OF HON. JAMES E. RISCH, RANKING MEMBER, AND A U.S. SENATOR FROM IDAHO

Senator RISCH. Thank you, Madam Chairman.

First of all, this issue is not a new issue, and we are so glad to have somebody from Micron Technology here. She has a background that can tell us all about this.

Micron Technology is the world's second-largest maker of DRAMS in the world. It was founded in a garage in Boise, Idaho, by three very entrepreneurial people and it has grown to what it is today.

Boise does not have access to the large pool of engineering talent like a lot of places in the country have; and so, for many years under the leadership of Steve Appleton, who we tragically lost not long ago, Micron Technology set about doing what everybody in this room is talking about today; and that is, fostering an understanding and an interest in the STEM education not only for young people but all the way through the colleges and universities.

Micron has been a tremendous benefactor of the universities as far as engineering education in Idaho.

Having said all of that, they also recognize the pragmatics that we have today; and that is, even with all these efforts, and they have made Herculean efforts in Idaho, they still are not able to get the talent that they need.

So, the visa program at least as we work our way through trying to get more students interested in this and bringing more students on line is going to have to play a major role for American companies.

And, I meet with American companies every day, including ones in Idaho, that cannot get the help that they need to do the work. Now, that does not mean the work is not going to get done. What it means is the work is not going to get done here. It is going to get done overseas and we are going to lose tremendous benefit from that.

So, it is important that we do focus on all aspects of this. The work that we do today for kids that are just starting out that you, Ms. Wang, referred to is not going to bear fruit for many, many years to come, indeed, in two decades.

So, we have to focus on all aspects of this, and I believe that is what we should talk about here at the hearing today.

Thank you, Madam Chairman.

Chair LANDRIEU. Thank you very much.

Senator Shaheen, thank you for joining us.

OPENING STATEMENT OF HON. JEANNE SHAHEEN, A U.S. SENATOR FROM NEW HAMPSHIRE

Senator SHAHEEN. Thank you, Madam Chair and Ranking Member Risch, very much for holding this roundtable discussion.

I especially appreciate all of you who are here to join us in this discussion as we think about how do we ensure the skilled workforce that we need in the future, and that is really, I only heard the end of what you said, Ms. Wang, but I think that is the point you were making is that we have got to make sure that we have students who are engaged in STEM subjects.

And, I think one of the ways to do that is through providing more opportunities for hands on experience in those STEM subjects; and we have some great examples of programs like the first robotics competition, Raytheon's Rocketeer program, the real-world design program, all of which provide that kind of hands-on experience.

One of the things we need to do is to encourage schools to participate in those programs. I am going to introduce legislation tomor-

row to try to do that; and hopefully, as you all know, we can get more and more of our young people particularly starting at that age to get excited.

And, I have to say, Madam Chair, and I think this is a particular issue for young women and girls because, while women make up about 48 percent of the workforce, they only make up about 24 percent of the STEM the jobs in this country.

And so, we really need to encourage them to get away from the stereotypes that state girls are not good at science and math and let them know they can do anything they want to and we need them involved in these subjects because we need their skills for the future.

So again, thank you very much, Chair Landrieu, for holding this very important discussion today.

Chair LANDRIEU. Thank you so much. As usual, you hit the nail on the head because many of these small businesses represented here need those women with those skills so that they can grow these small businesses represented here and that is exactly why we are holding this roundtable. So thank you.

Senator Pryor.

OPENING STATEMENT OF HON. MARK L. PRYOR, U.S. SENATOR FROM ARKANSAS

Senator PRYOR. Madam Chair, I will put an opening statement in the record but I just want to say thank you for doing this and thank all of you for your leadership on this. It is obviously very important. We need to get it right. We need to keep America and globally competitive and to stay on that front edge of the global economy.

So, thank you for doing this.

[The prepared statement of Senator Pryor follows:]

Senator Pryor's Opening Statement

Bridging the Skills Gap: How the STEM Education Pipeline Can Develop a High-Skilled American Workforce for Small Business

The U.S. economy is facing a growing workforce gap. Employers are having a difficult time filling job vacancies with skilled workers and potential employees are not able to find jobs that fit the skills they have. Ensuring that workers have the right education and training is critical to a 21st Century workforce.

The gap between employer needs and workforce skills is starkest in the critical areas of STEM education, as technical skills become increasingly important in the workforce. Yet while demand is growing rapidly, the U.S. is on track to respond with only modest increases in the number of graduates in STEM related fields.

There is growing recognition that individuals need a wide array of skills in order to meet the needs of the modern workplace. These skills include

- being able to solve complex problems,
- to think critically about tasks, and
- to effectively communicate with people from a variety of different cultures and using a variety of different techniques.

Second, the use of computers interacts with the kinds of jobs available. Computers are particularly good at performing some types of jobs, such as those that require routine tasks, rely on rule-based logic, and can be programmed. Increasingly, computers are replacing humans in performing these types of jobs.

I am proud to be an original cosponsor with Senator Landrieu of her bill S.288, the Women and Minorities in STEM Booster Act of 2013. Also, last year, Senator Wicker and I introduced the Workforce Innovation for New Jobs and Applied Education, or WIN JOBS Act, S1948. Developing a more competitive workforce is part of my Six-Point Solution to Job Creation.

I want to thank all of the roundtable participants for their time and I look forward to hearing their suggestions.

Chair LANDRIEU. Wonderful. As you know, this is very informal and my members can jump in and follow up with questions. I will get us kicked off; and if you want to respond or think of something, just raise your placard here.

But let me start with the Department of Education, if we could, would you briefly explain what the Administration's positions and efforts are on this domestic workforce enhancement.

The Administration also, I think, supports opening opportunities for foreign workers to come in and has been supporting that balance that the Committee has been discussing and, of course, the immigration bill that passed out of Committee last night. So, the information, members, that we gather today will be, I think, helpful for our floor debate that will ensue in a few weeks.

But on the Department of Education, Mr. Uvin, Deputy Secretary of Office of Vocational and Adult Education, just give us two minutes to kind of kick off this discussion and then anybody can jump in to ask questions, et cetera; and then, Ms. McAdams, you may want to add something as well.

Go ahead, Mr. Uvin, explain how this consolidation is going to work; and try to give us an understanding of what—the total is $3.4 billion—what percentage of that is of the total, you know, amount of education spending at all levels, both federal, state, and local if you have it and if not you could submit that were the record.

But go ahead.

Mr. UVIN. Chair Landrieu, thank you.

Some of the specifics that you are requesting at the end of your comment, we will get to you. I do not have these handy. So what I would like to do is maybe give a little bit of an overview of the STEM reorganization proposal.

Chair LANDRIEU. Try to lean into your mic. I am so sorry.

Mr. UVIN. Sure. No problem.

Chair LANDRIEU. I do not know what to do with these microphones. I cannot do any better but you have to just lean into it or we cannot pick up your voice.

Mr. UVIN. Is this better?

Chair LANDRIEU. Better.

Mr. UVIN. I will talk a little bit about this comprehensive reorganization of STEM education programs to support what we have called a cohesive national STEM strategy to increase the impact of all the federal investments.

As I alluded to quickly, our 2014 budget proposal advances the idea of consolidating or restructuring more than half of the 226 STEM programs and take and redirect funding from 78 of these programs to the four priority areas I outlined earlier.

One is pre-K through 12th grade instruction, undergraduate education, graduate fellowships, and then informal education activities.

Chair LANDRIEU. What was the fourth one? Informal?

Mr. UVIN. Informal education.

Chair LANDRIEU. Informal.

Mr. UVIN. Yes.

The Department of Education in this effort would lead the improvements in the P through 12th grade instruction area by sup-

porting partnerships among school districts and universities, museums, federal science agencies and their facilities, businesses and other community partners to transform teaching and learning.

The department would help organize many of our Nation's school districts into what we have called STEM innovation networks that can develop, share, and replicate best practices for effective teaching and provide rich and up-to-date content knowledge in the STEM areas.

There is also a focus in this comprehensive plan on preparing and recruiting high quality K through 12 STEM teachers and to recognize and retain our most talented STEM teachers through the creation of what we have called a National STEM Master Teacher Corps.

So, by reorganizing and realigning resources, this proposal facilitates greater investment and rigorous evaluation and evidence building strategies to meet our critical national goals such as increasing the number of undergraduates with a STEM degree and broadening—and this is a very important point that has been alluded to already—participation by under represented groups.

The reorganization will also make it easier for educators and school leaders to navigate the spectrum of STEM education resources and identify effective strategies to improve teaching and learning.

Chair LANDRIEU. Let me stop you there.

Mr. UVIN. Sure.

Chair LANDRIEU. And just to get this discussion going, Mr. Goodman, and Ms. Mooney, does anything that you are hearing from the Administration make sense to you all about the needs of what was going on in Idaho that your company—and I understand that your company and Idaho have been promoting STEM development in the schools in Idaho—is anything that you just heard similar to what you all have been doing?

Also, Mr. Goodman, you said that a Nation that has kids that understand how to program computers will be important. Is anything that you are hearing here important to you?

Let us start with you, Ms. Mooney.

Ms. MOONEY. Yes, thank you, Chair Landrieu.

Absolutely, everything that I heard are programs that we are already involved in or definitely support. We believe that pipeline is very necessary so getting the kids young in school, getting excited about math and science and then having programs that follow them all the way.

But we definitely believe that the teacher in front of the classroom, if they have the content knowledge and the passion for math and science, that is very important. And so, with the master teacher program, we are aware of that and we have several programs that also support those kinds of initiatives.

Chair LANDRIEU. Okay. Since I agree with that, let me ask—is the Administration supporting merit pay for master teachers, do you know?

Ms. MCADAMS. I would say that merit pay by its definition is usually fairly controversial and probably not something we are supporting. What we are supporting is relationships with districts or regions or even with an individual school where the best and

brightest teachers can be rewarded for doing something extra, not just at their school, which is what they are doing right now.

Great teachers are helping their colleagues all over the country right now by being more of a national resource. Taking excellent teachers that are in North Carolina working very hard at some of the most upcoming STEM schools and STEM magnet programs and taking those teachers and having them be more of a national resource.

The support would be maybe in the form of a stipend but it could also be in the form of relief time or other opportunities to be leaders within their district as a recognized role.

Chair LANDRIEU. Okay. And the reason I ask this is because my own personal experience with nurses is, I think, instructive.

We have many openings for nurses in Louisiana. We cannot fill all the slots that we have, and the reason is because our State or Federal Government or combination thereof cannot find nursing instructors because the nurses can make $100,000 in a hospital doing nursing but they can only make $50,000 instructing other nurses.

So I mean, how do you solve this problem?

Senator RISCH. Pay teachers more.

Chair LANDRIEU. Well, pay the good teachers more and be able to be able to recruit the kind of teachers you need to produce the work force you need.

Now, this is not rocket science. I mean, I am struggling with this in our own State. These nursing positions are STEM, are they not?

Ms. MCADAMS. Yes, of course.

Chair LANDRIEU. They pay very well. But we are bringing in foreign nurses because we cannot figure out a way to get nursing instructors in front of community colleges or universities.

So, I am hoping that the Administration has their eyes all over this and is focusing on this. Let me get to you, Doctor, and then I will get you Ms. Casey.

Senator RISCH. Madam Chairman, let me get my two cents worth in.

Chair LANDRIEU. Go right ahead.

Senator RISCH. This stuff is not rocket science. When I became governor, we had the same problem in Idaho. I built two nursing schools and paid the teachers more and all of the sudden the nursing shortage went away. But it is not rocket science.

Chair LANDRIEU. Well, if everyone was as smart as this governor we might not have a problem. I might have to send my governor to go talk to him because we are still having a problem in Louisiana. That is a great solution.

Senator RISCH. The problem was exactly the same way. When I became governor, we had 800 empty positions for nurses; and the people who were in our nursing schools were exactly the kind of people we were trying to help.

They were mostly single moms who had really not much of an ability to make a living and all of the sudden they got out of nursing school and they are making 40 some thousand dollars a year and had a job and most were signed up long before they got out. But this stuff is not rocket science.

And I am going to go to the government now. You say you have 226 programs dealing with the STEM issue?

Mr. UVIN. Over 200, yes.

Ms. MCADAMS. Yes. The current funding is over 220 programs.

Chair LANDRIEU. And they are consolidating it down to four.

Ms. MCADAMS. No. Consolidating it to approximately half of that with four focus areas with three lead agencies—the Department of Education, the NSF, and the Smithsonian Institution.

Senator RISCH. How about one program with a very smart person heading that program? That is what we do in the private sector.

Yet, you know, with all due respect and I mean this sincerely with all due respect, as I said in my opening statement, this is not a new problem.

The government, the Federal Government and the State governments have been poking at this. I spent almost 30 years in our State senate and time as governor and lieutenant governor, and it does not seem, I would like to see these that this takes. Has somebody got statistics on the number of graduates with STEM degrees, because the perception is we are not making much progress in this regard? Encourage me. Give me some numbers.

Chair LANDRIEU. Does anybody have those numbers, and if not, if you would submit it and I am sorry, Doctor, you had your card up, and then I will get to you, Camsie.

Ms. FERRINI-MUNDY. Thank you. I was just going to pick up from my colleagues from the Department of Education and talk about the National Science Foundation's piece of this reorganization, where our focus would be on two other really important steps in the pathway to working in business and industry, and those would be the undergraduates and graduate preparation and just a couple of quick notes.

At the undergraduate level, the attrition rate for students who start college thinking that they would like to pursue STEM and then who finish is very poor and it varies by field and it varies by gender and it varies by race and ethnicity, and we can get you specific numbers. But we are losing people who come to college thinking they are ready to pursue STEM.

So, a big focus in NSF's leadership within this proposed reorganization will be at the undergraduate level. How can we ensure that the instruction that students are getting in STEM is of the highest quality? How can we assure that they are getting real life experiences early on in their experience as undergraduates?

And then at the graduate level, the government offers a number of fellowships and traineeships across agencies and what we understand from the data—and we can get you some specifics—is that although students completing PhD's are perhaps well prepared for academia, their preparation for other places of work may not be as strong.

And so, our hopes, in doing some revisions of our graduate research fellowship program, are to increase learning opportunities outside of the academic pathways, such as opportunities in labs and in companies.

Chair LANDRIEU. Since I am a numbers person, like my Ranking Member, and our other members would be interested, if you could submit for the record before this Committee is closed, give us like a 10-year look-back and maybe a five-year projection of these graduate students and the attrition, you know, success or failure, rate

broken down, I mean, over all and then broken down by some various categories that would make sense for us, because my general sense of it, and I could be wrong, governor, is that, you know, we are making progress but we are just not making enough progress.

And so, I think part of the goal of this Congress should be not just immigration reform—not really focusing on this skills gap, but, particularly for this Committee, how the skills gap relates to small business.

I mean, the opportunity is there, especially when you take into consideration the statistic I gave out before you all came in, I think 62 percent of small businesses are under hiring. That means they want to hire more, have the money to hire more, but cannot find the qualified people that they need.

So, you know, this is really an economic issue as we all know.

Senator RISCH. Before we move on, can I follow up?

Doctor, that is really interesting, the comment that you made that there is a bottleneck there at the bachelor level where they come in thinking they are going to pursue STEM, and then go out of it.

What is your sense? Why do they go out of it? Do they go out of it because it is too tough, that they are not prepared, or that they had any romantic idea that they were going to be rocket scientists and they found out it was not what they thought? What is the reason for this switch in pursuit?

Ms. FERRINI-MUNDY. Thank you for the question. Probably all of the above but what the data show us in particular is a set of concerns about instruction, that is to say, they came excited but then they are not sure when they get into some introductory courses about what the real world applications might look like, whether they will really have a chance to use what they know.

Senator RISCH. But that is true in most pursuits.

Ms. FERRINI-MUNDY. Right.

Senator RISCH. I mean, get into college and you take a 101 course. It is hard. You know what I mean.

Ms. FERRINI-MUNDY. Right, and the other thing that we think may be a issue is preparation, particularly in mathematics, because even when students come with a pretty strong background in K through 12, the jump to college-level introductory mathematics, particularly the math needed for the STEM careers, is sometimes a challenge.

So, we have a number of efforts to try to focus on getting this math gap fixed.

Senator RISCH. Interesting. Thank you.

Chair LANDRIEU. Yes. So, they might have come into college with a 3.5 in math but the problem is that the math level that they took in high school has not adequately prepared them for the actual math that has to be done.

Now, you would catch that in an ACT test or you would catch it at an SAT. But you would not normally catch it by just a grade point. And, many of our colleges have open enrollment.

But go ahead, doctor, and then I will get you, Camsie.

Dr. KOLVOORD. Senator Landrieu, actually you do not catch it in the SAT score. What we are finding is they are not able to apply the mathematics that they learned. They can perform quite well on

the SAT and then they get into an introductory engineering course or they get into another introductory course and they stumble because they are not literate in the mathematics.

I think that is a major challenge. My experience is in line with Dr. Ferrini-Mundy's.

I would add one more thing. Particularly in the STEM areas, students have to slog a long time before you get to the interesting stuff.

The programs that we have designed at JMU try to get students to applications much earlier so they can understand and be motivated to work through the basic materials so that they can actually do the work that interests them in the first place. The stuff that Newton did 400 years ago is not quite so interesting to students these days.

[Laughter.]

Chair LANDRIEU. No wonder I did not move into that field.

Mr. Goodman, go ahead and then I will come back.

Mr. GOODMAN. Thank you very much.

Chair LANDRIEU. This is very interesting. I want to follow up on the SAT but go ahead.

Mr. GOODMAN. Yes, I wanted to hit on that one as well. Thank you.

I do have some numbers that there are 40,000 graduates a year in STEM, and right now the jobs created in STEM is 120,000 a year. My understanding also, and I do not know these numbers exactly, is that the number of STEM graduates has gone down by .8 percent since 2000 and the number of history graduates has gone up by three percent since 2000.

I think the comment that was made by the doctor in terms of making it fun, we treat technology like a career choice, not a common denominator.

So, we teach biology. We teach science. We teach math. But we do not teach them as a means to an end. We teach them as a means to get a grade.

And, I think somebody made a suggestion in one of our meetings yesterday that, if there was a class on how to build an app for money in high school, that kids would see that it is a means to an end and it would not be this open-ended Newton experience. I mean, the programming languages we teach in college are 40 years old. That would say if I wanted to be a writer, well, why do you not learn Latin. It is about taking advantage of what we have.

So thank you.

Chair LANDRIEU. Excellent comments Mr. Goodman. I really appreciate that and I sure hope the Department of Education is listening because this is such a fundamental flaw or shortcoming I should say—some people may say flaw—shortcoming in our education system. We have got to step this up and be teaching kids where their interest is, their excitement to fill the skills gap.

Ms. Casey, I will get to you and then I will run this line. Go ahead.

Ms. MCADAMS. It is Camsie.

Chair LANDRIEU. Sorry.

Ms. MCADAMS. Thank you.

I wanted to talk about two or three things. One is, Ranking Member Risch, you talked about one really great program and I would say that my colleagues around the table, Ms. Wang, Ms. Taylor, Ms. Belsky and Ms. Mooney, would probably say that one program does not really cut it. There are different niches within IT, for example, or within software development.

And that even within nursing, there is the pathway of being a neonatal nurse versus a surgery nurse versus a home health care aide.

I think that we need to be really careful to make sure that we are letting regional economies determine what is the best for what is in their neighborhood.

So, the program, the STEM innovation networks, is designed to let folks like the people in Boise come together and say, what opportunities do we have right here; the people in Louisiana to say, we have a real shortage in nursing so we are going to design a whole K through 12 pipeline pathway program much like Ms. Mooney was speaking about, to really start in the very early grades with these informal activities, these informal exposures where you bring STEM professionals into the classroom so that kids can see different opportunities for careers and then follow that up all the way into the high school with a great opportunity to do advanced coursework even before they get to the college campus so that they do not necessarily hit the ground at a deficit and can take advantage of dual credit and dual enrollment and advanced placement coursework.

These are the kinds of things that are built into the design of the STEM innovation network, and these are the kinds of things I think will generate both interest and excitement.

Being a neonatal nurse is a very serious STEM occupation. I met a young woman in Maine who wanted to be a neonatal nurse but she did not know how to find a derivative. She did not know how to do proportional thinking in her head.

I thought, well, you have a long way to go. So, we have to do a better job from the beginning of inspiring the interest and then all the way to the end with academically rigorous and relevant coursework.

To the computer science point, I think this is something that also these networks could do. They could emphasize, if you are in a tech corridor, the IT pathway. There are programming opportunities that can be done in elementary schools, not just in high school.

We can start very early on, and some of these resources are free. Alice and Scratch, these are resources that are out there that have been developed through grants that are open resources available to everyone.

The last thing I want to point out is, to clarify, to your first question that you asked about merit pay, is that the department supports performance pay and there are efforts to link teacher performance to student outcomes, whether we measure those through multiple means, but we do support the idea of having teachers being paid for performance that is linked to better outcomes for students, which is really what this is all about.

Chair LANDRIEU. I appreciate your clarifying.

Ms. Belsky, go ahead and comment; and then if anyone knows a region where what Ms. McAdams just talked about, a region or an example where, because, as the governor said and senator, my Ranking Member, this has been going on a long time and there are some states and regions that might be doing a little bit better on this and closing that gap. We would like to put that on the table if anyone knows.

But go ahead, Ms. Belsky.

Ms. BELSKY. Sure. So, it is tremendous to hear more about the pipeline efforts that are going—that are taking place—now that the government is proposing.

One thing this brings to mind, though, is, you know, what are we going to do now for startups that are building their businesses today.

I think right now in particular we are in a moment where startups are sexier and have grabbed the attention of popular consciousness in a way that they have not before. What we need is not only to address the long-term pipeline but figure out how to get employees to our companies today.

I can tell you at Kaltura the company that I run today, we end up hiring, we have about 10 percent of our positions which are continuously open despite the fact that we have taken expensive venture capital funding, are paying interest on that, and we cannot fill them.

So, what we have done is we have hired people, particularly women, who do not have technical experience. We send them to courses. We set them up with mentors. Over time many of these folks have turned out to be very, very productive employees.

The thing is we need to be able to scale this and I am sure some of my other colleagues here would need similar solutions as well. So, I guess one question I am putting forth, we have heard from the dean over here that there are interesting workforce partnership programs but what else is out there that we could potentially scale to address in the pipeline.

Chair LANDRIEU. An excellent point. And if you would put your placard down so we can see you.

But I would like to follow up on this point because here at the table we have sort of the Administration and Education and Labor, et cetera, what they are doing. But an interesting question that Leah raises is her business is doing something now about the skills gap.

My question is: As a small business, how do you line up to get the H–1B visas that are going to be available for foreign workers? That is one question.

Is it first come first serve in the bill? Is there a set aside for small businesses in America? If not, why not or should there be, et cetera, et cetera?

And then for domestic, are we doing anything in your proposals that would help a business like Ms. Belsky—either through a tax credit or anything that might be helpful while they are doing their own training?

Instead of using schools and universities, this business, like many businesses in my State, do their own training. And they are so desperate to find the kind of workers they need.

Are we doing a thing to help them? Does anybody know? Does anybody know if the government is doing anything? Is it just strictly your company?

Ms. BELSKY. So, I do not know of any other government programs. We are certainly not doing this in partnership. We are interacting with colleagues in the startup community to take these initiatives together but that is all, to my knowledge.

Chair LANDRIEU. Ms. Fiala.

Ms. FIALA. A couple of things that I can talk about, and I will save the discussion on the H–1B technical skill grants for a second but that is a piece of this.

When you talked about, Senator, retraining, that is near and dear to our heart as well because there are a lot of middle skill jobs in the STEM area and other areas that, perhaps, Ms. Belsky and others out there, small employers, could take advantage of.

I mean, we know that much of the growth today is being done by small employers and is very difficult to connect, and you just gave the story.

We have a network of 2700 American jobs centers around the country who can connect employers to various skill training programs. I was in a conversation a couple of days ago with a group that provides employers with opportunities through the workforce system to customize training and to be able to hire employees and to be able to customize the training for them so they can work and learn at the same time.

In fact, the H–1B technical skill training grants that we can talk about that are funded by a part of the fees that employers pay to bring in temporary workers that——

Chair LANDRIEU. So, you are saying a business like Ms. Belsky's could get one of those grants?

Ms. FIALA. It is not a grant. They could actually have, converse with the local workforce system in New York and talk about their skill needs and work out either a customized training grant, and employers have to put skin in the game.

Chair LANDRIEU. I think she has a lot of skin in the game.

Ms. FIALA. She has a lot of skin in the game. So, I think it is a great opportunity for her and we would be more than happy to connect her and others interested in that at the local level.

Chair LANDRIEU. I would like to make sure that this really works for small businesses that are so busy doing their business that they do not have a lot of time, of course, to figure out all of these government programs. And, I think that the simpler we can make this for customizing training because sort of the way I am looking at it is all hands on deck.

I mean, we have a real problem here, and it has to be solved by everybody doing everything we can.

Dr. Taylor, go ahead. And then I will get you Ms. Moneypenny.

Ms. TAYLOR. I wanted to the point about the applications, the math and science. I am a first-generation college grad. Neither of my parents attended college and I have a PhD in mathematics.

Now, some of the solutions that I am hearing sound a little bit traditional and one-dimensional. What I am thinking is that we get outside of the box, make it a little bit more multi-dimensional; and

I think the STEM students need to be more immersed into STEM activities beyond just training in school.

And, let me make this point. My husband has a PhD in physics. He is African-American, went to an HBCU as well. So, we are bit of an anomaly. I will admit.

However, our daughters live and breathe math and physics. They do not realize the advanced level but we bring it in to the home. It is a part of our culture. When I go to PTA, I participate in some of the classroom activities. The kids learn it. They do not realize it because I do not present it as Newton's theory or Einstein's philosophy.

So, there needs to be a different presentation to help demystify. Sometimes in the past, it had been where being a mathematician was a club, and it is definitely an honor, but it is not unattainable and it is not only for a particular group of individuals.

And so, when I go out, I have T-shirts that say, I love math or I am a mathematician; and I cannot tell you how many young women have come up to me and say, are you a mathematician? And, they say it very softly.

[Laughter.]

And I say, yes; and I am at the grocery store or I am at a 5K. I am in the community, and they see me in my everydayness, not looking like Einstein.

And, having the platform to speak about what it is that I do and the applications, and I also chose NC State—this is another very important point—because they had a different route for me to take. I did not want to become a professor right away.

Ultimately, I would like to be in the classroom but I wanted to apply my thinking, my skill set; and NC State had a program that was already in place that put the students out into the community in working with NIH in Research Triangle Park and all the other small firms that were in the area.

So, if we can re-create that, I think that it would kind of change the culture and be the recitation of STEM topics.

Chair LANDRIEU. Thank you, Dr. Taylor. Excellent point.

Ms. Wang.

Ms. WANG. Thank you, Senator. I actually wanted to tackle that. What could be done now from a small business perspective. I grew up in China.

Chair LANDRIEU. Is your button pressed?

Ms. WANG. I am sorry. I am an immigrant from China. I started learning math early and it was fun for me to learn. I took algebra at fourth-grade, and I programmed a computer when I was 18—13 I am sorry—games; and I had internship jobs placed via my school all summer, multiple summers. So, it was fun.

I think the culture really made a difference. But the other point I want to make, as a government contractor, we are providing technology solutions to the Department of Defense intelligence community. We simply cannot find enough cleared engineers today.

Chair LANDRIEU. Let us talk about your word "cleared." You have used this several times before. Are you talking about a security clearance?

Ms. WANG. Yes, ma'am. Security cleared, security clearance.

Chair LANDRIEU. And what is holding up the security clearance? Is it a backlog?

Ms. WANG. It is a huge backlog, and last year we had a contract where we won with an intelligence agency. We could not hire people from outside of that agency because they require a unique, separate clearance level that they do not accept any other agencies same level.

So, it was a very idiosyncratic process and they simply did not accept anybody else's package. So, there was no pool. The only pool of potential employees was people already employed at that agency.

Chair LANDRIEU. Okay. Can you tell us what agency that was?

Senator RISCH. I do not think she can.

Chair LANDRIEU. Okay. All right.

[Laughter.]

No, that is true. All right. The staff will look into that and figure out if there is any way we can open that up but you have said that three times now, so I wanted to be responsive. You just cannot find enough cleared engineers.

Ms. WANG. Engineer, yes. I think that process could be really improved.

Chair LANDRIEU. Okay. Ms. Moneypenny.

Ms. MONEYPENNY. Thank you. So, a couple of comments. Since we keep talking about rocket scientists, I really have one. I am an astrophysicist by background. So, it is not always helpful actually to solving all the problems but rocket science is a good way to think about it.

There are a couple of issues for us. You were talking a little bit about the caps and the H–1B visas. There is not a specific provision for small business to hire them so basically you are rushing just like everybody else, and if you do not have a staff of attorneys which obviously we do not as a small business——

Chair LANDRIEU. I want to really underscore this. I do not know if it is clear to everyone that in the current bill as drafted it is a first-come first-serve.

Ms. MONEYPENNY. That is right and that is the way it has always been.

Chair LANDRIEU. And, is there any alliance of small business owners or startups who have a better idea of how that should be so small businesses in America have an opportunity to get some of the——

Ms. MONEYPENNY. Not that I am aware of. We have had to learn how to do the process ourselves completely, just because it is very expensive obviously hiring resources that know about these things and then obviously being able to describe the kinds of jobs that we are looking for which are very specific technologies or skill sets that we are trying to get.

So, those are very difficult and it puts a lot of burden on us frankly. It is not just fees; it is burden.

Senator RISCH. You know, on a short-term basis, what she is talking about is really, really critical to this country.

Ms. MONEYPENNY. Yes.

Senator RISCH. We can talk about the long-term pipeline but for people that need them, that statistic that he gave where there are 120,000 jobs created and we are graduating 40,000.

Ms. MONEYPENNY. Right.

Senator RISCH. You know, I just found a way to employ another almost 100,000 people.

Ms. MONEYPENNY. That is right.

Chair LANDRIEU. I know but the problem is what you have correctly identified as the long-term pipeline. It is important for us to get this solved.

The short-term is need but the small businesses sitting at his table will not get any of those pieces. They will not get any so it is not going to be solved. I mean under the current draft of the bill, I doubt that any small business represented here is going to get any of those visas because they are all going to be snapped up by big companies that are already scheduled to do it, already know the process, and already have the resources to do it.

So, if our Committee does not come up with some suggestions, I am not sure what is going to happen. Go ahead doctor, Dr. Kolvoord.

Dr. KOLVOORD. Thank you, Senator Landrieu.

I wanted to loop back to a short-term solution and give a more concrete example. I will be very brief.

We are working at JMU with a different model. Camsie McAdams talked about dual enrollment and dual enrollment is where we help students in high school earn college credit but it has been very traditional and in very typical courses.

We have taken a very different tack on dual enrollment and we have partnered with schools in Virginia to help students learn about geospatial technologies, such as GPS, geographic information systems, and remote sensing. And, when I leave here, I will be headed back to Loudoun County to see students present their end of year presentations.

This is a very different kind of problem solving that students are doing particularly in this high-stakes testing regime. So, we are seeing students actually getting engaged with technology. One student actually learned Python Scripting on his own to be able to do his project.

They are then coming out of high school ready to engage in college in a very different way. We have not received a single federal dollar to do this.

We were able to create this program because there is a tuition flow from the dual enrollment. It would be very easy for universities across the country to begin this program in a variety of different technology areas, and I think it might be something that could start this flow of people.

It is perhaps, to follow Dr. Taylor's analogy, outside of the box just a little bit. We have been doing it for eight years, so we have some experience.

Chair LANDRIEU. I am going to ask each of you for this Committee record to submit literally a one-page document about your best, fastest idea to solve this problem. Okay, any one-pager to the Committee before the close of the record and, Bob, if you would put that on your list, that would be terrific.

Dr. Mundy.

Ms. FERRINI-MUNDY. Thank you. I just wanted to circle back also to the questions about the immediate needs of small businesses and to reiterate the importance of partnership.

And, at least in working with the National Science Foundation, I will call your attention to four different programs and can give you more details later.

It would require partnering with some local university or community college but then there could be resources that would be useful after the merit review process.

One I mentioned earlier, the advanced technological education program. The second is one of our H–1B visa receipt-funded programs. It is called ITEST, Innovative Technology Experiences for Teachers and Students or for students and teachers, I guess.

That is a program. It is part of what we call informal science education outside of school. It can involve summer opportunities, summer learning internships in companies and so forth as a way to begin to build the pipeline.

And then, CREST which is Centers of Research Excellence in Science and Technology. This is a program for minority serving institutions but there is an option for partnering with small business and local industry in that program.

Then finally, we have a program called Scholarships for Service to your point, which is about providing dollars to universities and community colleges actually to prepare students who can work in the cyber security workforce within government.

So, what I want to do is go back and check on how the restrictions are relative to working with government contractors. But in any case, there is a set of students coming out of that program who are receiving scholarships and who are ready to meet security clearances.

Chair LANDRIEU. Go ahead.

Mr. UVIN. I just wanted to add an important resource, I think, for small businesses and local communities to be aware of, and it is our $1.1 billion investment in career and technical education.

The money goes to States because States know better than us at the Federal level what to do with the money, and they can allocate it to school districts and post secondary education institutions to provide more technically oriented forms of education.

Many of the States right now have encouraged local communities to create strong partnerships with small businesses and large businesses and have moved into the STEM areas.

There are some exciting examples about emerging early college high schools that are focused on the STEM fields that deliver not only a high school credential to students but also an associate degree and a series of industry certifications and a job.

So, I would be happy——

Chair LANDRIEU. Is this the Carl Perkins block grants?

Mr. UVIN. Yes. People are now——

Chair LANDRIEU. $1.4 billion that the Federal Government sends to——

Mr. UVIN. $1.1 billion right now.

Chair LANDRIEU. $1.1 billion, the Office of Vocational and Adult Education.

It would be very interesting for this record if you would submit what you think are the top three to five programs in the country, because I find this very hit or miss in my experience.

I think some states do a good job with spending this money, other states do not. You know, if it was being spent really well over many years because we have been getting it out, we would not have the skills gap that we are talking about.

So, you have to acknowledge the reason we have a skills gap, I mean, I think you have to accept that we have not been spending our resources and our allocations; and our education system is failing to produce the domestic workforce.

So, you know, moving around the edges is going to help but it is not really going to be transformative. What has to happen, I think, and we are not the Education Committee, but for small businesses that need workers I think we, our Committee, has to advocate for a more transformational approach which is what I am thinking I am hearing.

So, if you could give us the three or four best examples of the states that are using part of this $1.1 billion, I mean, really hard data to show excellence, I think it might help.

All right. Go ahead.

Senator RISCH. Madam Chairman, Mr. Uvin, when you go back, you said something we do not hear in Washington, D.C., very often. Put it as the opening statement in your policy manual, the states know how to spend this money better than the Federal Government does.

There are a few of us here that believe that, and that is absolutely critical to us. The complaint I get most of all at home is the strings that the Federal Government attaches whenever money comes, particularly from the Department of Education. That has been very controversial.

Mr. UVIN. Just a quick response if I may, Chair Landrieu. Last year, we launched our blueprint for transforming career and technical education in this country, and it is exactly to address some of the concerns that you have raised in your comment.

One of the things we are advancing is a greater responsiveness to what the real needs of businesses are, a closer collaboration with our colleagues in workforce and economic development at the state level and a stronger role for states to work with our educational institutions so that they understand where the real business needs are, where the emerging sectors are.

We would be happy to share that document with all the members present here.

Senator RISCH. I am glad you realize that. We have realized that in Idaho a long time ago. We have between the State and our businesses in Idaho we have a strong, strong working partnership.

In fact, we pride ourselves at asking them to come in and say, what do you need? As a result of that, I can give you all kinds of examples. Particularly our technical colleges can respond quickly to a request from small businesses, medium-size businesses, even big businesses to provide a program that trains people for them.

So, we have known this for a long, long time and at least in Idaho we are very nimble at that and very good at it. I am glad that realization has come to Washington, D.C.

Chair LANDRIEU. Ms. McAdams and Ms. Fiala.

Ms. MCADAMS. Thank you. I just wanted to highlight that from the members of this Committee there are several states that are part of a coalition called the STEMx and these are an organization of states that have taken a statewide and state-focused approach towards STEM learning. I think you asked earlier, Chair Landrieu, for examples of regions where this is going well so I would say we could look to members——

Chair LANDRIEU. What are some of those states?

Ms. MCADAMS. I can read them off. So, Washington State, North Carolina, Idaho, and Kentucky are all part of the STEMx, plus Michigan, Maryland, Massachusetts, and Florida all have significant efforts at the state level.

In fact, I just spoke with the people from Michigan STEM. They are having a meeting in two weeks in Detroit around business opportunities, called Michigan STEM and I provided an opening statement for them on how our proposals would help support what they are doing in Detroit to try and revitalize the workforce there.

I also looked to the states where I could not find a statewide effort; so, for example, in Louisiana, where in Jefferson Parish there is the Patrick Taylor Science and Technology Academy, which was formed as a partnership between local businesses and the school.

But I looked in their course catalog and they are not offering a single computer science class. So I think that there is an opportunity for us to take some measures to inspire students in the nontraditional fields.

And, I think Dr. Taylor's point was very, very important about the idea of informal learning and engagement because there is not always a path for teaching a course on how to create apps for money within the regular courses needed for graduation.

But that could easily go along with what Senator Shaheen talked about with First Robotics, in the after-school space, in the summer time, on the weekends, because the rocketry challenges and the design challenges are building those skills.

And, just last week they had the "Rockets on the Hill" event. I spoke to that group and I talked about how the partnership model is so incredibly important because what happens is professionals like Dr. Taylor and Ms. Moneypenny and Mr. Goodman come in and help support the teachers and maybe do not have those rocketry design skills and I think that is a way to also encourage meaningful partnerships.

So, I am happy to connect with folks about the work of STEMx but STEMx is only one opportunity.

Chair LANDRIEU. Well, that is wonderful; and if you would send that information to the Committee because what we are hearing is that some states are doing a really good job and some states are not.

Not every state does a great job and not every state's programs are better than the Federal Government. What you are saying is some are and some are not, and I would tend to agree with that. Ms. Moneypenny.

Ms. MONEYPENNY. Thank you. A couple of points I want to raise. Small technology firms are really like the bellwether for the industry. So, I would really want to encourage, when we were talking

about partnering with business, that there are specific provisions that the educational institutions have to talk to small businesses because otherwise the temptation in those programs is basically to go out to the largest employers in the area because that is what people usually do. That is the way they usually respond, right. But no, specifically go out and canvass what small businesses are looking for.

And then, the other point I want to talk about is this thinking about partnering with other large companies that have certification sort of programs. So, it is the Microsofts, the IBMs. Those certifications mean something in the industry.

A lot of times small businesses are already serving large companies, and so getting enterprise sort of certifications, serving enterprise technologies, I am sure you guys are working with them. So, having those certification programs maybe as part of some of those educational things that we are teaching and that actually helps us to have those people who are informed on the workforce side. They have certifications.

So, even if they do not graduate, they still have something that helps them become a productive member of the workforce and that has value in the workforce from an engineering standpoint.

Chair LANDRIEU. Thank you. Our Committee has reached out to Microsoft and to some of these larger companies because of this. We see them as partners just like the way I see as Chair, the Federal Government as a partner and we would like to make it a better partner, a more efficient partner.

I also recognize some of these very large technology companies can be part of the solution of helping us to reach small businesses, et cetera, et cetera. So, thank you.

Senator Shaheen and then I will get you, Ms. Mooney.

Senator SHAHEEN. Thank you, Senator Landrieu, and I am sorry. Since I had to go away for a little bit, I may have missed some of the discussion. So, I am not sure if you have gotten into the immigration legislation that is being discussed or not.

But it is my understanding that it addresses STEM in a couple of ways. One is by increasing the number of H–1B visas which has been an issue for a number of high-tech businesses in my State of New Hampshire.

But it also sets up a fund to help support STEM workers in various ways and STEM education. And, I wonder if there are any small business people on the panel who have had any experiences that you think would be helpful as you are looking at either the H–1B visa program or as you think about a STEM fund and how that might be used.

And then, I had a specific question also for Dr. Ferrini-Mundy, who I understand your brother is from New Hampshire. So, that is very nice. I know him very well. He used to be the mayor of Portsmouth. So, it is very nice to have you here.

Can you talk about what the Science Foundation is currently doing on STEM education and how the STEM fund that is being talked about in the immigration bill might be helpful to those efforts?

Chair LANDRIEU. Excellent questions. Thank you. Who wants to respond? What anybody? Go ahead, Mr. Goodman.

Mr. GOODMAN. I wanted to speak specifically to the visa process for a small company. To quote my CEO, he was very excited to talk to the IRS after he got off the phone with the immigration office.

[Laughter.]

Chair LANDRIEU. That is not very good. But go ahead.

Mr. GOODMAN. It cost us, we have done a total of four. One of them was easy but across the board has cost us somewhere between $25- and $35,000 with special counsel, educating ourselves, making mistakes.

Senator SHAHEEN. For each one?

Mr. GOODMAN. For each one.

Senator SHAHEEN. Wow.

Mr. GOODMAN. 40 to 80 hours of man time.

Chair LANDRIEU. Right.

Mr. GOODMAN. Now, contrast that to paying $40- or $50,000 to a recruiter and not having to deal with any of those complexities. We have actually resolved not to go forward with any more H–1Bs to solve our problem.

And, in mitigating, I actually go out to lunch with one key programmer that we cannot find a parallel to every two weeks and fix anything that upsets him because we cannot afford to lose him.

Senator SHAHEEN. Wow.

Chair LANDRIEU. Of all of what I have heard this morning, Senator Shaheen and Senators, this concerns me the most. I mean, we are getting ready to pass, potentially pass an immigration bill with an H–1B visa program that is probably not going to work for any small business in the country.

I mean, this is a very interesting, I mean, I do not know. Is this what I am hearing? Now, I say "any". That is broad but let us just clarify. For businesses under 50 to 100 people, because they are not going to be able to navigate, and you, Mr. Goodman, hire how many people?

Mr. GOODMAN. We have over 35 people now.

Chair LANDRIEU. Thirty-five people.

So, if it costs them that much money, and from what I understand, Senator Shaheen, there is no quota set aside for small business. There is no special express lane for small business.

We may want to think about creating that before this bill gets out of here. I do not know the pros and cons but we are exploring that today.

But what I am pretty clear about is none of those H–1B visas are going to get in the hands of a business got 50, or very few, will get in the hands of businesses that are 50 or more.

Yet, that is where all the patents rest, not all. That is where the majority of patents rest. That is where most of the innovation rests and that is where most of the new job creation is.

So, this is a very interesting, you know, line of thinking and discussion we have going on here. Did you get your second question answered?

Senator SHAHEEN. No.

Chair LANDRIEU. About the National Science Foundation.

Chair LANDRIEU. The National Science Foundation. What are you all doing?

Ms. FERRINI-MUNDY. Of course, thanks for the question, Senator Shaheen.

The National Science Foundation has been engaged in STEM education since its founding. So, we have 60 plus years of experience there.

Our budget spent on STEM education is about $1.2 billion, all spent through competitive merit-reviewed grants, the majority of that in the directorate that I lead, Education and Human Resources.

We fund in the areas of STEM learning and learning environments. So, we are interested in projects and proposals that will improve STEM learning and that will provide us with the evidence for how to do that well so that we can then become a place that provides these well-tested models for use broadly across the country and to scale, in particular in partnership with the Department of Education and other agencies.

We also fund and have had a long tradition of funding in the area of broadening participation and improving the engagement of groups that have traditionally been underrepresented in STEM.

Then, we are increasingly engaged in sharpening our focus on preparing the STEM workforce. We fund, as we say, pre-K through gray kinds of projects so for the general public, for schools, for inside and out of school in all of these STEM fields; and we do this through about 30 separate programs.

Chair LANDRIEU. Could I add something though? When you said that, Senator, one of the issues, and this comes really from small businesses that need to speak up.

Ms. Mooney, I will get to you in a minute.

We have to be careful about what we are measuring. If we are measuring just who graduates with what degree, you know, we may be spending a lot of money getting just like you said, Ms. Taylor or Ms. Wang, people with degrees.

But having a degree and having skills, the right skills, are two different things. And, I think that is what our small businesses are telling us is that you can have all the chemistry majors you want, all the, you know, math majors you want; but they have got to be math majors with the skills that our entrepreneurs in America need today; and that is a question we should constantly ask ourselves.

Ms. Mooney.

Ms. MOONEY. Thank you. I just wanted to let members of the Committee and the rest of the roundtable participants know of a study that the Micron Foundation is engaged in with the University of Idaho, and we are talking about the factors that influence family, a student's ability to go into a STEM career and excel at a STEM career. It is a longitudinal study.

There is data out there if you just Google University of Idaho Micron STEM Study, and it provides a little bit of information on what those factors are and perhaps a multi-partnership approach to community, parent, teachers, and students to get them excited about STEM education.

Senator SHAHEEN. Can I just follow up on that?

Chair LANDRIEU. Go right ahead. Yes.

Senator SHAHEEN. One of the things that I think is so interesting about some of the hands on programs that kids can participate in is that some of the data that I have seen shows that they have a higher percentage of actually going into STEM fields because they have a chance to work with mentors. They have a chance to see what the opportunities are in those fields and they have a higher graduation rate in those fields and then they get out and they actually go to work in STEM fields.

I just wondered if any of you have, if you are far enough in your study to see if that is what the data you are seeing is showing or if anybody else has any experience with that kind of data that shows that that really does make a difference?

Chair LANDRIEU. Could you respond, Ms. Mooney, do you know?

Ms. MOONEY. We are in preliminary findings but it does seem that project-based learning, a teacher with significant content knowledge, a family that supports math and talks positively about it instead of saying things like, I was not good at math, you will never need this type of thing are a factor.

Chair LANDRIEU. Teachers that have had experience in the private sector, for a math teacher to come right out of school and just be in the classroom teaching math as opposed to being in a company applying math and then going into teaching which gets back, Governor, to, and these governors sitting on either side, you know, makes me be even a stronger advocate for alternative certification for teachers, to try to get people in front of students that have had real world experience either building a small business as an engineer themselves or as a mathematician themselves or working in a small or large company and then going into the classroom and explaining how these subjects that are very important and exciting and it was definitely what the country needs.

So, this is a real challenge before our country. Doctor, and we are going to end in five minutes. I am going to get you and then we are going to do wrap-ups.

Dr. KOLVOORD. So, very briefly to two points the first is to Senator Shaheen's. Dr. Olga Pierrakos, who is a faculty member in our engineering program and supported by the National Science Foundation, has done affirmative research along this line.

And, she is finding that those students that have those hands-on experiences are starting to more identify themselves at a younger age as engineers or scientists and it seems to carry forward to college.

The other point I would make is an amen to Ms. Moneypenny about the connection with small businesses. In two instances at JMU, we have reached out and redesigned academic programs towards more generalist programs because the business and industry were telling us that is what they wanted. They wanted students with strong STEM skills but that could apply them in a variety of contexts.

They were not trained only as physicists, chemists, or mechanical engineers; and our students have found a lot of traction in the startup world and in small business because of this different skill set that students coming from more traditional programs do not have.

Chair LANDRIEU. And I think our universities have to really wake up here and figure out how to think out of the box like you said, Dr. Taylor, and really stepped up to get this workforce in America moving in the right direction.

Ms. Fiala, and then we are going to have a one minute wrap ups or 30 second wrap-ups from everybody. Go ahead.

Ms. FIALA. A couple of quick points. The point on contextualized learning, the ability to kind of test out what you are learning from the classroom to the workplace is not just important for K through 12 and academics.

We are finding that with adult learners, people who are going back to retraining, this is extraordinarily important.

So, in the competitive grants that we award under the H–1B technical skill training program and frankly in our other grants, we have emphasized that people think outside the box in terms of building partnerships between community colleges and employers. And, we think it is important to have states there but we really believe that it needs to be employers at the regional or local level that need to articulate the skills and be engaged in the design of training and offer these work-based opportunities whether it is internship or a cooperative education program or at a secondary level it could be much shorter exposure to work.

But to be able to make sure what is learned in a classroom is tested and valued in work, and we are identifying promising practices through H–1B skill grant programs with our partners.

Chair LANDRIEU. And how much is in that grant program this upcoming year? What is proposed for your grants?

Ms. FIALA. I can tell you what we have spent. So far in the last two rounds it is about $342 million in two rounds of H–1B technical skill grants competitions.

Chair LANDRIEU. Okay.

Ms. FIALA. And the nice thing about this is to be eligible to compete it has to be a partnership either of a business or a group of businesses or a trade organization and a post secondary education institution and the public workforce system so that you have the right partners at the table to really change and make a difference.

Chair LANDRIEU. That is great and I would like some more information on that.

We are going to go 30 seconds, real quick. Anything you did not say that you want to get on the record. The record will be open until June 6. And Senator Shaheen and Senator Risch had to leave.

But go ahead, Ms. Wang.

Ms. WANG. Thank you, Senator. I just want to make a point, enhance a point about connecting small businesses to this program. We need the help now; and we are, in fact, with JMU, we did an innovative partnership informal because we have been looking for security-cleared enterprise architects which no university actually produced until just a few years ago.

JMU is one of them. Penn State is another one. We connected with JMU informally and has started to build a pipeline for our business.

Chair LANDRIEU. Okay. Dr. Taylor.

Ms. TAYLOR. Thank you. I want to thank everyone for the opportunity to be present and to share my perspective and I think it is

very important that we go beyond this roundtable here, that we all continue the dialog because a lot of good ideas came about and it needs to be transformational as the Senator stated. And so, I would suggest and encourage all of us to put our thinking caps on and to continue to think outside of the box and to make STEM a part of our everyday life and culture and to not make it so monumental as being, and to demystify it. So, thank you.

Chair LANDRIEU. Thank you. I am going to ask the staff to circulate to all of you the e-mails and contact information from all of you which is probably readily available on the Internet, but we will make it easy for you so that you all can stay in touch. I think this would be a good group of advisers for one another.

Ms. Moneypenny.

Ms. MONEYPENNY. So, just two points to wrap up. Again, thank you for the opportunity. I really appreciate it.

The other point is really how are we going to do the communications to small business, because I hear 226 programs. I hear about grants. I hear about all of this stuff but I really would like to know how are you going to communicate that to small businesses.

We are already busy, never mind about fighting the visa process. We are also busy doing those things as well as actually trying to hire staff and run our own businesses. So, how do we get to know about these new programs that the government is going to bring forward, you know, we really encourage that.

Then the other part is really just in terms of partnership and getting the needs of our businesses into the curriculum. A lot of times, you know, it is like when we were talking before it is about, you know, 13-year-old people can build applications right now. They have the skill set. Some of them can learn if they have the willingness to learn from the Internet right now.

Sometimes colleges are still teaching FORTRAN, which is from a language that nobody cares about and never will probably ever again.

And so, so many people are learning these skills but it is like that is what kills you. That is why you do not want to graduate. If you know how to build an app for iTunes already, learning FORTRAN is going to put you to sleep. You are just going to get out there as fast as you can.

Chair LANDRIEU. Can we find out how many universities are still teaching, what is it, FORTRAN? I would like the staff to find out and I would like a list of which ones they are.

Ms. MONEYPENNY. Yes.

Ms. KOLVOORD. Not ours.

Chair LANDRIEU. Okay. I would like to know that. Go ahead.

Mr. GOODMAN. I would like to thank you. This has been a tremendous experience getting to participate in this. You illustrated some parts of the problems that I did not understand with the comparison to nursing. I think that was excellent.

I realize that all of the greatest people that I work with are all working. They are not out teaching, and I think that that is a big part of the problem.

But I also just wanted to reiterate that we do not just teach driving to people that want to become race car drivers and that it is these common skills and this passion. We have a thing in our com-

pany which is what I call the "I made this" moment and that is possible with this technology and that is when you transfer accountability of the outcome to the child and I think that is really when it comes to light.

So again thank you.

Chair LANDRIEU. Thank you so much. It is so refreshing to hear your words and thoughts.

Ms. Mooney.

Ms. MOONEY. Thank you. My company is no longer a small business but it certainly once was and it grew from the basement that Senator Risch talked about. We still are the only company of our type that produces and manufactures in the United States and that is the talent that was here that has helped us grow. So, our foundation is still very involved in helping kids become engineers and scientists in the future so our companies and other small businesses can continue to grow.

Chair LANDRIEU. And how large is your company now and when did you start?

Ms. MOONEY. We started in 1978. We now have 20,000 employees in nine different countries.

Ms. MONEYPENNY. Amazing. And you have helped to grow your own pipeline in Idaho?

Ms. MOONEY. Absolutely.

Chair LANDRIEU. Great.

Ms. Belsky.

Ms. BELSKY. Thank you again for having us here as well.

What I am realizing at the end of this discussion is that we in the startup community have supported the broader immigration bill and I think not fully realizing where it might not help us.

But one positive thing is I think until you have an organization like Engine Advocacy there have not really been that many organizations that pulled together the tech startup community and made them, given them a connection to Washington.

So, I look forward to connecting with my colleagues on the panel here and bringing them into our organization but hopefully we can actually be a channel so that when the Committee does come up with other more specific ideas, we can disseminate them to the startup community which is sort of cheering in general but, I think, not really realizing how to effectuate the program.

Chair LANDRIEU. Exactly. And you will be cheering yourself to no visas if we do not do something about this.

Go ahead, Ms. Fiala.

Ms. FIALA. Thank you, Senator, and I was madly taking notes while people were talking. So, it has been very useful. We are getting ready to think through our next round of H–1B technical skill training grants. So, I appreciate that.

We are trying to help not only students but also adults, vulnerable long-term unemployed, under represented groups acquire skills in high-skill occupations including STEM. So, this was very useful to us.

Chair LANDRIEU. Thank you.

Ms. MCADAMS. Thank you so much. This was an incredibly diverse group of people but I think we all have the same common purpose. So, one of the best things for me at this table is to be a

female in STEM surrounded by females in STEM who are taking it home to the kitchen table and talking with their little girls about this.

In 10 years of teaching I kept thinking I was doing a really great job but the truth is we all have to do a really great job and we all have to inspire our students and I think that the Department of Education's launch into leadership in this space represents the belief that schools and teachers and districts cannot do this alone, that we really need partners.

So I look forward to working with all of you and hope that you will feel free to e-mail me with ideas after we leave this room.

Chair LANDRIEU. And I would just hope to add that you look to businesses like Micron, big businesses that could anchor that effort in each state, because I think you will find very good partners in the business community that can help the Department of Education hone and craft what their businesses need.

And if you could identify two or three businesses in each state. For the Department of Education, it would seem to me that would be a piece that is probably missing and probably needs to be fixed.

Ms. MCADAMS. Thank you.

Mr. UVIN. Thank you for the opportunity to be here and also thank you for your leadership around all of these issues. I just want to underscore the importance of creating pathways that start early and that we can only do that if we engage our business partners actively in this.

Those of you who are familiar with some our most recent reform proposals know that we are advancing an empowered role for businesses in our education reform work and there is more of that coming.

Chair LANDRIEU. Thank you.

Ms. FERRINI-MUNDY. Thank you so much, Senator, for this session. It has been fascinating and energizing. One thing we did not get a lot of time to talk about, but now that we are going to be able to contact each other I look forward to doing so, is the particulars of the competencies and skills and knowledge that are needed in different sectors by different types of businesses.

That is the sort of thing that I think we are all interested in, in understanding how to prepare people with those competencies and skills and how to measure them well because back to the point about it is not just about numbers of people graduating; it is really about whether they are graduating with the sort of quality experiences that enable them to really perform in the workplace.

So, thank you again for the opportunity and the NSF looks forward to being a partner with you.

Chair LANDRIEU. Thank you. Doctor.

Dr. KOLVOORD. Senator Landrieu, thank you very much for a very stimulating roundtable. Thanks to all the participants.

There are institutions of higher education like James Madison University who are willing to be flexible, who want to innovate, who want to be responsive; and I think part of our job is to reach out and continue to share the lessons both the positives and the negatives of the experiences that we have had as we think about how to address these issues.

This is a systemic problem. But the assessment piece that Dr. Ferrini-Mundy mentioned is also one that is critically important for us in higher education to actually show that there is value added to the experience and we are working hard on that at JMU as well.

Chair LANDRIEU. Well, thank you and our roundtable is adjourned. We really appreciate it and the record will be open until June 6.

[The participant information follows:]

[Whereupon, at 11:45 a.m., the Committee was adjourned.]

APPENDIX MATERIAL SUBMITTED

Biography of Bob Kolvoord, Ph.D.
Co-Director, Center for STEM Education & Outreach
James Madison University

Education

- Ph.D., Theoretical and Applied Mechanics, Cornell University (1990)
- M.S., Materials Science, University of Virginia (1985)
- B.A. Physics, University of Virginia (1983)

Experience

- Co-founder and Associate Director, Center for Image Processing in Education
- Co-founder, Science Approach

Scholarly Interests/Research Topics

- Geospatial Tools
- Applications to K-12 Education
- Curriculum Development
- Professional Development for K-16 Teachers
- Evolution of students' spatial thinking skills
- Applications of GIS
- Data Visualization
- Recruitment and Retention in STEM Education
- Simulation and Modeling

Publications

- Keranen, K. and R. A. Kolvoord (2008). **Making Spatial Decisions Using GIS**. ESRI Press, Redlands, CA.
- Keranen, K. and R. A. Kolvoord (2011). **Making Spatial Decisions With GIS**, 2nd Edition. ESRI Press, Redlands, CA.
- Keranen, K. and R. A. Kolvoord (2013). **Making Spatial Decisions Using Remote Sensing**. ESRI Press, Redlands, CA. (In press)
- Kolvoord, R., M. Charles and S. Purcell (2013). **What Happens After the Professional Development: Case Studies on Implementing GIS in the Classroom.** Chapter in Learning Science Through the Innovative Use of Geospatial Technologies Designing Effective Learning Tools and Programs for K-16 Settings. Barnett, Michael; MaKinster, James; Trautmann, Nancy (Eds.). Springer-Verlag. In press.
- Kolvoord, R.A. and D. Edelson, editors (2012). MyWorld GIS Curriculum Collection. National Geographic Society. Washington, DC.

Projects

- Geospatial Semester
- Center for Rural STEM Education
- Project VISM - Visualization in Science and Mathematics
- Project GODI - Great Outdoors, Digital Indoors
- Bridging the Valley

Research Support

- Annenberg/CPB Math and Science Project
- National Science Foundation
- Spatial Intelligence and Learning Center
- State Council of Higher Education in Virginia
- US Department of Education

Biographical Sketch
Dr. Joan Ferrini-Mundy

Dr. Joan Ferrini-Mundy is Assistant Director of the National Science Foundation (NSF) for Education and Human Resources, a position she has held since February 2011, and is responsible for the leadership of the NSF Directorate for Education and Human Resources (EHR). She had served the Foundation in a number of capacities since 2007 including as inaugural director (through an Intergovernmental Personnel Act appointment) of the EHR Directorate's Division of Research on Learning in Formal and Informal Settings.

From 2007 through 2009, Ferrini-Mundy was a member of the National Science and Technology Council's (NSTC) Subcommittee on Education, and currently co-chairs the Strategic Plan workgroup of the National Science and Technology Council Committee on STEM Education. She is a member of the Mathematics Expert Group of the Programme for International Student Assessment (PISA), and in 2007-2008,representing NSF, she served as an ex officio member of the President's National Mathematics Advisory Panel, and co-chaired its Instructional Practices Task Group. From 1999 – 2011 Ferrini-Mundy held an appointment at Michigan State University (MSU), where she was a University Distinguished Professor of Mathematics Education in the Departments of Mathematics and Teacher Education, and Associate Dean for Science and Mathematics Education in the College of Natural Science. Her research interests include calculus teaching and learning, mathematics teacher learning, and mathematics and science education policy at the K-12 level. Ferrini-Mundy holds a PhD in mathematics education from the University of New Hampshire. She was elected a fellow of the American Association for the Advancement of Science in 2011.

Statement of Johan Uvin, Deputy Assistant Secretary, Office of Vocational and Adult Education, and Camsie McAdams, Senior Policy Advisor, STEM, Office of Program Evaluation and Policy Development

U.S. Department of Education

May 22, 2013

Before the Senate Committee on Small Business and Entrepreneurship

Roundtable on *"Bridging the Skills Gap: How the STEM Education Pipeline Can Develop a High-Skilled American Workforce for Small Business"*

Chairman Landrieu, Senator Risch and other members of the Committee, we appreciate the opportunity to participate in this Roundtable discussion on how the STEM education pipeline can develop a high-skilled workforce for the future. The issue of STEM education and preparation for the global economy continues to be a top priority for the Administration and is reflected in our 2014 budget proposal to Congress.

Scientists and engineers create many of the innovations that drive our nation's global competitiveness. Our nation's capacity to create and innovate must not be limited by a shortage of talent in science, technology, engineering, and mathematics (STEM) fields. To prepare our students for STEM jobs and other high-skill careers, we must provide them with meaningful opportunities to develop knowledge and competencies in these subjects.

STEM occupations are projected to grow much faster than others; 15 of the 20 fastest growing jobs require a strong background in math and science, like biomedical engineers or network systems and data analysts. Workers with STEM skills also have higher-quality jobs, higher earnings, and are less likely to be unemployed. Yet fewer than half of American students are proficient in math and science, and we are falling far behind many of our global competitors. Meanwhile, Federal STEM investments have proliferated over the years to include more than 220 programs across 13 different agencies. This fragmented approach to investing in STEM education has made it difficult to ensure that Federal efforts are coherent, strategic, and leveraged for greatest impact.

The Administration is proposing a comprehensive reorganization of STEM education programs to support a cohesive national STEM education strategy and to increase the impact of Federal investments. The 2014 Budget proposes to consolidate or restructure more than half of the 226 STEM programs and redirect funding from 78 programs to improve four priority areas: pre-kindergarten-through-grade-twelve (pre-K-12) instruction; undergraduate education; graduate fellowships; and informal education activities.

The Department of Education (ED) would lead improvements in P-12 instruction by supporting partnerships among school districts and universities, museums, federal science agencies and their facilities, businesses and other community partners to transform teaching and learning. ED would help organize many of our Nation's school districts into STEM Innovation Networks that can develop, share and replicate best practices for effective teaching and provide rich and up-to-date content knowledge. There is also a focus on preparing and recruiting high-quality K-12 STEM teachers and to recognize and retain our most talented STEM teachers through the creation of a national STEM Master Teacher Corps.

By reorganizing and realigning resources, the proposal facilitates greater investment in rigorous evaluation and evidence-building strategies and in meeting critical national goals, such as increasing the number of undergraduates with a STEM degree, and broadening participation by underrepresented groups. The reorganization will also make it easier for educators and school leaders to navigate the spectrum of STEM education resources and identify effective strategies to improve teaching and learning.

We look forward to discussing in greater detail the importance of STEM education in preparing a workforce for the global economy and thank you again for the opportunity to participate on this panel.

Science, Technology, Engineering and Math (STEM) Education

America must provide students with a strong education in science, technology, engineering, and mathematics (STEM) to prepare them to succeed in the global economy. Despite an annual federal investment of almost $3 billion, too many American students are unprepared in math and science, particularly students from underrepresented groups, and the nation's STEM workforce needs are not being met. Reform in this area is stymied by the Federal's government's fragmented approach to STEM education, which is reflected by Federal investments in over 220 programs across 13 different agencies.

To facilitate a cohesive national strategy, the Administration is proposing a comprehensive reorganization of STEM education programs to increase the impact of Federal investments in four areas: K-12 instruction, undergraduate education, graduate fellowships, and education activities that typically take place outside the classroom. The reorganization involves consolidating or restructuring 114 STEM education programs across 11 agencies and improving the delivery, impact, and visibility of STEM efforts. Nearly $180 million will be redirected from consolidated programs to the Department of Education, the National Science Foundation (NSF), and the Smithsonian Institution to implement initiatives in the four core reform areas.

NSF will focus on improving the delivery of undergraduate STEM education and reforming graduate fellowships. The Smithsonian Institution will improve the reach of federally supported informal education activities, and help align those activities with State standards so that they are relevant to what students are learning in the classroom. The Department of Education will lead the following initiatives to improve K-12 STEM instruction:

- **STEM Innovation Networks ($150 million).** This program will provide competitive grants to local educational agencies (LEAs) in partnership with institutions of higher education, nonprofit organizations, other public agencies, and businesses to increase the number of students who are effectively prepared for postsecondary education and careers in STEM fields. Eligible partnerships will develop comprehensive plans for identifying, developing, testing and implementing evidence-based practices to provide rich STEM learning opportunities for students in participating LEAs and schools. To support the implementation of these plans, STEM Innovation Networks (STEM-INs) will employ of wide range of strategies—depending on local needs— in areas such as the recruitment, preparation, and professional development of effective STEM educators; the development and testing of teaching and learning models that enable students to successfully meet STEM-focused college- and career-ready standards; and student engagement in STEM subjects.

- **The STEM Virtual Learning Network (approximately $5 million).** The STEM Virtual Learning Network (STEM-VLN) will create a professional learning community of STEM educators. This community, operating primarily but not exclusively online, will enable STEM educators to share innovative STEM content, effective STEM teaching strategies, and

research on STEM education. The funding for the STEM-VLN will come from a set aside from the larger STEM-INs program.

- **STEM Master Teacher Corps ($35 million).** In July 2012, the President proposed creating a national STEM Master Teacher Corps that would enlist America's best and brightest science and math teachers to improve STEM education. The Corps would recognize and reward the most accomplished STEM educators by offering them membership in a national community of talented STEM educators, opportunities to serve as instructional leaders in their schools and communities, and additional pay in exchange for their leadership and service. The President's budget request includes $35 million to pilot the STEM Master Teacher Corps before it is taken to scale.

- **STEM Teacher Pathways ($80 million).** To support the President's ambitious goal of preparing 100,000 excellent STEM teachers over the next decade, STEM Teacher Pathways will provide competitive grants to recruit and train effective and highly effective STEM teachers for high-need schools.

- **Effective Teaching and Learning: STEM ($150 million).** Formerly the Mathematics and Science Partnerships program, this program will fund partnerships between local education authorities (LEAs) and institutions of higher education (IHEs) that will help States improve teaching and learning in science, technology, engineering and mathematics. Funds will be used to support State implementation of comprehensive, evidence-based plans; professional development that aligns Federal, State, and local resources to promote high-quality STEM instruction; and for subgrants to high-need LEAs to support comprehensive STEM instruction in the grades and schools with the greatest needs.

- **Fund for the Improvement of Education ($30 million).** These funds will be used to expand the Improving Mathematics Achievement and Transition to College from High School (IMATCH) program, a joint initiative between ED and NSF. The program will help develop, evaluate, and scale up effective practices that increase student achievement in mathematics during the critical transition period from the last two years of high school through the first two years of college.

Dr. Johan E. Uvin
Deputy Assistant Secretary of Policy and Strategic Initiatives, Office of Vocational and Adult Education (OVEA) U.S. Department of Education

Dr. Johan E. Uvin joined the Office of Vocational and Adult Education in December 2009 as Senior Policy Advisor to Assistant Secretary Brenda Dann-Messier. In 2011, Dr. Uvin was appointed to the position of Deputy Assistant Secretary of Policy and Strategic Initiatives. In that capacity, he coordinates all policy and strategy development for the Office of Vocational and Adult Education. This office is responsible for adult education, including corrections and reentry education, secondary, postsecondary and adult career and technical education, and community colleges. In 2012, he also became the Acting Director of the Policy Research and Evaluation Services division and the co-chair of the Interagency Forum on Disconnected Youth, a multi-agency federal collaboration to improve the outcomes of disconnected youth. Since 2010, he has also been a member of the steering committee of the Domestic Policy Council's New Americans Citizenship and Integration Initiative which developed a framework for federal efforts on immigrant integration.

Prior to his appointment, Dr. Uvin led the Rhode Island state office that oversees adult education, career and technical education, and GED testing.

Dr. Uvin hold a Doctorate in Administration, Planning and Social Policy and a Master's in International education from Harvard University. He also holds a Master of Arts in teaching English to Speakers of Other Languages (TESOL) from the School of International Training in Brattleboro, Vermont.

Bio of Camsie McAdams

Camsie McAdams is the Senior Advisor on STEM Education, advising the US Department of Education on P–20 STEM issues. Her work includes carrying out strategic planning for STEM at the Department, serving on multiple inter-agency STEM education groups and representing the Department's STEM commitments in a variety of public-private forums. Appointed to this position in August 2012, McAdams represents the Department in the strategic planning process for the federal Committee on STEM Education (CoSTEM) and is leading the design of a major STEM innovation initiative for the second term under Secretary Duncan and President Obama. Under a proposed major reorganization in STEM funding across the entire Administration, the Department would lead efforts to transform P-12 STEM teaching and learning; McAdams and a team of leaders from across the Department have designed a suite of complementary STEM initiatives to streamline, target and direct investments to reach more teachers and more students, more effectively. "

Prior to her appointment at ED, McAdams served as the Director of STEM for DC Public Schools where she led K-12 curriculum design, professional development and instructional improvement. McAdams created a vision for STEM in DCPS, engaged multiple external stakeholders in the DC area, and launched a full-scale STEM strategic plan. McAdams also designed and led the district's Common Core State Standards for Mathematics roll-out and implementation in the spring/summer of 2012.

McAdams has a degree in general engineering and political science from the University of Denver, and a Masters of Education from the Harvard Graduate School of Education. She taught middle/high school math and science in Oakland, CA and New York City for 10 years, and helped start and run a small public school in the South Bronx. McAdams received the Presidential Award for Excellence in Mathematics Teaching in 2009. She served as an Albert Einstein Distinguished Educator Fellow at the National Science Foundation from 2009-2011.

STATEMENT OF

GERRI FIALA
DEPUTY ASSISTANT SECRETARY
EMPLOYMENT AND TRAINING ADMINISTRATION, DEPARTMENT OF LABOR

COMMITTEE ON SMALL BUSINESS AND ENTREPRENEURSHIP
UNITED STATES SENATE

May 22, 2013

Chairman Landrieu, Ranking Member Risch, and Members of the Committee, thank you for inviting me to speak about the work we are doing at the Department of Labor (Department) to meet the skill needs of America's small businesses.

To help create an economy that is built to last, the Department is continuing its work to ensure our nation's workers have the skills that employers need, to fill in-demand positions, including jobs in high-growth industries that utilize H-1B visas. Alignment of the workforce's skills and abilities with employers' needs is an essential component to our economic recovery and long-term competitiveness.

The Bureau of Labor Statistics Occupational Outlook Handbook indicates that occupations that usually require a post-secondary non-degree award or a post-secondary degree for entry are expected to account for about 37 percent of all new jobs from 2010 to 2020. Middle and high skilled workers will be critical to meeting American employers' needs. Post-secondary graduation and credential attainment rates in high-growth occupations must rise in order to help both U.S. workers and U.S. businesses succeed in the global economy.

The Department is working to strengthen the domestic science, technology, engineering, and math (STEM) worker "pipeline" by leveraging robust inter-agency and public-private partnerships, aligning the national network of around 2,700 American Job Centers and their partners with local and regional labor market needs, strategically awarding competitive grants that engage community colleges and employers in technical skills training, and customizing training to meet the needs of employers and workers.

Overview of the ETA-Funded Public Workforce System

A majority of the Employment and Training Administration's (ETA) budget consists of Federal grants provided by formula to states for employment and training services and unemployment insurance benefits. Although the public workforce system is primarily federally funded, most of its services for businesses and workers are operated at the state and local levels.

Most ETA grant funding flows annually to states and territories based on a statutory formula that considers factors including each state's population and unemployment. In turn, each state distributes its formula grant allotment among its local areas. ETA provides policy guidance and

oversight to the states, while each state does this for its local areas. States and local areas have wide latitude to develop and administer workforce development programs that best fit their unique economies and labor markets within established parameters.

The public workforce system's services are provided through a decentralized nationwide network of nearly 2,700 local American Job Centers. These centers provide services, funded by the Department of Labor and multiple partner agencies, to workers seeking employment and training opportunities and to employers seeking qualified, skilled workers.

How the Public Workforce System Assists Small Businesses

Employers are one of the "dual customers" of the workforce system (the other customer being the worker). Strengthening the role of business in the workforce system, ensuring training responds to the needs of the labor market or industry, and enhancing outreach to businesses are priorities of the Department.

States and local workforce areas provide direct services to businesses through Business Service Representatives (BSRs), Rapid Response Staff (deployed to assist employers and workers facing mass layoffs), and other "front-line" staff. BSRs at American Job Centers can be a critical resource for startups and other small business that want to hire additional talent but lack in-house, specialized human resources staff.

American Job Center services to businesses can include:

- Recruiting, screening, and referring a variety of job seekers, ranging from entry level workers to highly-skilled professionals
- Hosting job fairs and providing office space for on-site screening and interviewing
- Offering workforce information about wages, employment trends, and national comparisons
- Developing customized, on-the-job, or workplace training programs
- Supporting employee retention by offering services such as transportation, childcare assistance, and mentoring programs to individuals engaged in training

The Department is building front-line job center staff members' capacity to effectively serve business customers through on-line learning opportunities available on a dedicated section of ETA's technical assistance website at http://businessengagement.workforce3one.org/. These resources include a complete training curriculum that focuses on critical skill areas such as developing relationships with business, refining outreach strategies, and aligning business services with demand.

The Expanding Business Engagement Technical Assistance grant initiative supports the strategic planning and implementation of revitalized or enhanced business engagement activities. Currently 13 states are bringing together industry representatives; Federal, state, and local practitioners; and business to refine their business engagement activities, respond to the needs of local economies, and improve program performance. Online resources are being developed and disseminated on-line at http://businessengagement.workforce3one.org/ebe-ta-initiative as they

become available. Of particular note is a toolkit that ETA developed and released in 2011 to highlight "promising practices" in business engagement. This toolkit, entitled *Channeling Good Ideas Into Jobs: Workforce Partnerships that Support Entrepreneurs and Small Businesses,* is available at http://businessengagement.workforce3one.org/resources/files/small-business-toolkit.

In addition, ETA collaborates with employers and industry associations to document the skills required in emerging and economically vital industries through competency models. Competency models support workforce development strategies by providing a common language for employers to communicate their workforce needs. Competency models help ensure that workers have the knowledge and skills needed for success in jobs with good pay and advancement opportunities. So far, more than 20 industry-validated competency models have been developed for a variety of demand sectors, including energy, healthcare, manufacturing, and IT. The competency models and related on-line resources are available at http://www.careeronestop.org/competencymodel/.

Fourteen successful partnerships between the public workforce system and employers to support workforce needs in critical U.S. industries are highlighted in a U.S. Government Accountability Office (GAO) report released in January 2012, entitled *Workforce Investment Act: Innovative Collaborations between Workforce Boards and Employers Helped Meet Local Needs* (GAO 12-97, available at http://www.gao.gov/products/GAO-12-97). GAO found that almost all of the collaborations grew out of efforts to address urgent workforce needs of multiple employers in a specific sector, including STEM-related sectors such as health care or advanced manufacturing. Additionally, the partners in these initiatives made extra effort to understand and work with employers so they could tailor services such as jobseeker assessment, screening, and training to address specific employer needs. In all the initiatives, partners remained engaged in these collaborative efforts because they continued to produce a wide range of reported results, such as an increased supply of skilled labor, job placements, reduced employer recruitment and turnover costs, and averted layoffs.

Pathways and Partnerships for a Skilled Workforce

As we invest in skills development, we will not only help individuals return to work, but we also will help workers obtain the measurable and specific skills needed to advance in their career pathways, while giving employers access to the skilled workers they need to compete globally.

The Department plays a vital role in increasing access to industry-recognized credentials, in partnership with community colleges, businesses, labor unions and other stakeholders (such as community-based organizations). The Department set a high priority performance goal to increase credential attainment among customers of the public workforce system, and has emphasized occupational training that leads to an industry-recognized credential or certificate in our formula and discretionary programs.

The Departments of Labor, Education, and Health and Human Services issued a joint commitment letter in April 2012 to promote the use of *career pathways.* (available at http://wdr.doleta.gov/directives/attach/TEN/ten_36_11_att.pdf) These models focus on specific occupational sectors, including STEM fields, and align education, training and employment, and

human and social services among public agencies and with employer needs. Career pathway models help individuals of varying skill levels to earn credentials valued by employers and to enter and advance to increasingly higher levels of education and employment in in-demand and emerging industries and occupations. The three Departments are encouraging the use of career pathways models in their respective grant programs, including the Department of Labor's job training in STEM-related and other high-growth occupations.

TAACCCT

The Department is working diligently to engage community and technical colleges to bolster skills training among jobseekers. Through the Trade Adjustment Assistance Community College and Career Training (TAACCCT) grants, the Department has invested nearly $1 billion in coordination with the Department of Education to support substantive partnerships between eligible institutions, employers, and community-based organizations that are building the capacity of community colleges to meet the needs of trade-affected workers and other adults.

These competitive grants are geared towards developing education and career training programs that take two years or less to complete result in skills and credentials that are relevant for employment in high-wage, high-skill occupations, including STEM fields. In addition, the program's emphasis on producing open educational resources means materials produced through this funding can be leveraged by colleges across the country, not just those that received funding.

TAACCCT grants have been awarded to eligible institutions in all states. For example:

- The "Retraining the Gulf Coast Workforce through IT Pathways Consortium" of nine community colleges, led by Bossier Parish Community College in Louisiana, won a $14.7 million TAACCCT grant to implement evidence-based information technology career pathway programs leading to industry-valued credentials and degrees. The project will develop a new, core foundational curriculum that integrates basic skills instruction with technical training to accelerate academic achievement and credential attainment in multiple in-demand IT specialties, including Health Informatics, Cyber Security, and Industrial IT.

- North Idaho College won a nearly $3 million TAACCCT grant for its "Soaring to Success" program to provide accelerated learning and certification leading to employment in aerospace manufacturing and aviation maintenance.

- The NorthWest Arkansas Community College, leads a consortium of all 22 two-year colleges in the state. Based on extensive business and community outreach, research, and labor market data analysis, the colleges identified advanced manufacturing and healthcare as the primary target industries across the state, and each school is working to restructure two career pathways comprised of stackable, linked certificates and degrees. With an almost $15 million grant, these colleges are working collaboratively to accelerate program completions by 15 percent by reducing both the time it takes and the number of

credits required for community college students in Arkansas to complete certificate and degree programs.

H-1B Technical Skills Training Grants

Through the H-1B Technical Skills Training grant competitions, the Department has invested $342 million since October 2011 to provide training, job placement, and other assistance in the occupations and industries for which employers are using H-1B visas to hire temporary, high-skilled foreign workers. The Department's long-term goal is to decrease the need for H-1B visas by helping American workers develop the skills needed by these employers.

Of the top 10 occupations for which H-1B visas were granted in FY 2012, eight were in the STEM fields of information technology and engineering. In Fiscal Year 2011, nearly half (49 percent) of the H-1B visas certified and 70 percent of the permanent foreign worker visas certified were in STEM-related occupations.

An example of STEM-related training in H-1B Technical Skills Training Grants is the Arkansas Workforce Investment Board, which received a nearly $5 million grant for the Arkansas Partnership for Nursing's Future. The project is designed to train 1,500 unemployed, underemployed, and displaced workers, as well as incumbent workers, in the health care career pathway of Certified Nursing Assistant, Licensed Practical Nurse, and the H-1B occupations of Registered Nurse. The training strategies include on-line, classroom, and clinical training.

The Department will continue to use the H-1B grants to help individuals upgrade skills for high-growth industries and occupations, including those related to STEM. The grant program helps workers upgrade their skills while assisting businesses to retain and improve the skills of their workers, expanding their workforce as they successfully compete and prosper in the global economy.

Job Training and Economic Development Partnerships

The Department is participating in several inter-agency grant competitions to combine Federal investments in job training and job creation. The Jobs and Innovation Accelerator Challenge (JIAC) grants are a partnership between the Departments of Labor and Commerce and the Small Business Administration.

The first round of JIAC, which in September 2011 awarded a total of $37 million, supports grants for the advancement of 20 high-growth, regional industry clusters in order to promote development in areas such as advanced manufacturing, information technology, aerospace and clean technology. The projects are driven by communities that identified the economic strengths of their areas and encompass urban and regional areas in 21 different states. In October 2012, the Advanced Manufacturing JIAC competition awarded $20 million ($5 million from the Department of Labor) to ten public-private partnerships in nine states to help revitalize American manufacturing and encourage companies to invest in the United States.

An example of STEM-related training in JIAC is the ARK (Acceleration, Resources, Knowledge) project, led by Northwest Arkansas Community College in partnership with the University of Arkansas and Winrock international. This project received a $1 million grant to develop and grow new technology startup companies to provide innovative ideas, processes, and products to Arkansas' existing retail, food processing, and transportation and logistics industry clusters. The Department's portion of the grant supports education and training initiatives to build the workforce's IT skill sets.

Registered Apprenticeship

Employers have utilized Registered Apprenticeship for decades to train apprentices in traditional manufacturing and other occupations. Registered Apprenticeships are government regulated but privately funded and operated by individual employers or industry groups, and can also be sponsored in partnership with labor unions. Registered Apprenticeship is an efficient, flexible, "earn while you learn" model that provides employment and a combination of on-the-job learning with a mentor, related technical and theoretical instruction, and wage increases as apprentices progress.

In the past decade, Registered Apprenticeship has expanded to high-growth and emerging industries, including STEM-related ones such as health care, information technology, and advanced manufacturing. In Fiscal Year 2012, Registered Apprenticeship programs served 358,000 participants.

As the primary means of entry into a number of occupations, apprentices learn the latest industry practices to ensure that their training is relevant and meets the demands of the current marketplace. Registered Apprenticeship programs require applicants to have foundation-level skills in reading, math, science and technology. In addition, many organizations are looking to more formalized pre-apprenticeship programs that will provide career pathways out of poverty for non-traditional apprentices such as women and at-risk youth. Multi-disciplinary pre-apprenticeship approaches within various industries, including STEM-related industries, develop basic workplace skills such as writing, computer literacy, and customer service, as well as more occupation-specific skills such as blueprint reading and safety, to better prepare applicants for openings within apprenticeship programs.

Closing

In conclusion, we believe our myriad efforts support our shared goal of helping more Americans gain the skills to find good jobs in the 21st century economy and to spur growth in critical STEM industry sectors. We again thank this committee for holding a roundtable on an important topic, and we would happy to provide additional information and assistance as needed.

Biography of Gerri Fiala
Deputy Assistant Secretary of
Employment and Training Administration

Gerri Fiala recently joined the U.S. Department of Labor (DOL) as Deputy Assistant Secretary for Employment and Training. Prior to this, Gerri served as Staff Director to the HELP Subcommittee on Employment and Workplace Safety chaired by Senator Patty Murray. Here Gerri drafted Senator Murray's "Innovations in 21st Century Careers" bill to make education more relevant for high school students. She also developed bills introduced by Senator Murray during the economic stimulus debate. Key components of these bills were ultimately included in Recovery Act funding provisions for the Department of Labor.

Before coming to Capitol Hill Gerri served in a number of workforce development positions that impacted workers and businesses in the U.S. and abroad. This includes her tenure as Director of Workforce Research for the Workforce Development Strategies Group at the National Center on Education and the Economy. Accomplishments here include management of a project to help the Northern Ireland Department for Employment and Learning update its labor market information systems.

Gerri served for nearly eight years as Administrator, Office of Policy Development, Evaluation and Research, in the U.S. Department of Labor. This includes a year as a loaned executive to serve as Senior Counselor for Economic Development to the American Association of Community Colleges. As Administrator, she led interagency efforts to drive job training reform. This work culminated in the Workforce Investment Act of 1998, and Older Americans Act Amendments of 2000 (creating the Senior Community Service Employment Program). Her leadership on interagency teams also secured the Trade Adjustment Assistance Act, and Welfare to Work program, and provided direction to a DOL effort to craft and implement regulations for each of these programs.

Gerri has a Masters of Labor and Industrial Relations from Michigan State University, a Bachelor of Arts from the University of Iowa, and Associate of Arts from North Iowa Area Community College.

Biography of Leah Belsky

Leah Belsky is a technology executive, entrepreneur, and thought leader who specializes in open systems, tech policy, and application of technology to new domains.

She is the SVP of Operations and former VP Strategy and Assoc. General Counsel at Kaltura, a "TechCrunch Top 40" and Intel Capital funded company launching the world's first open source media platform. At Kaltura, Leah drives product and business strategy, interfacing with Fortune 100 companies like Adobe, Bank of America, and Pearson, as well as leading institutions like NYU, MIT, and 2Tor to define the future of education and media on the web. She was also a member of Obama's Technology Policy Committee and an early advisor to 'StartI', an edtech incubator and accelerator in NYC.

Leah began her career in international development & science policy at the World Bank and National Institutes of Health. There she received the Bank's "Innovation Fund Award" and led public-private development and democratization projects in Asia, Latin America, and Africa.

Leah is a graduate of Yale Law School and Brown University. At Yale she was a Knight Law and Media Fellow. She also studied innovation, community design, and open systems with Yochai Benkler at Harvard's Berkman Center for Internet & Society.

Leah's work has been published in leading academic journals, and she has presented around the world. She remains a fellow at Yale, a member of the Council on Foreign Relations, and a Pipeline Angels 2012 Fellow. She is also on the Board of Public Knowledge, a DC-based non-profit dedicated to freedom of information on the web.

Leah blogs occasionally at Opentec.org.

Specialties: entrepreneurship, open source, tech law & policy, edtech, media, video, tech & emerging markets

Dee Mooney | Executive Director, Micron Foundation

Micron Technology was once a small business dreamed up by a few entrepreneurs in 1978. Now, we have more than 20,000 employees worldwide with major facilities in 9 different countries, including our corporate headquarters, research and development facility and support labs in Boise, Idaho as well as a multi-billion dollar manufacturing facility right down the road in Manassas, Virginia.

For more than 30 years, Micron has redefined innovation by manufacturing some of the world's most advanced technologies. We engineer the innovations that make computing faster, travel safer, healthcare more effective, energy greener and much more. We are one of the world's leading providers of advanced semiconductor solutions and the only company of our kind to still manufacture products in the United States.

In 1999, Micron Technology endowed the Micron Foundation with $100 million, making it the largest corporate foundation in Idaho. Our mission is to support programs that strengthen STEM education and focuses on K-12 students, teachers, as well as university students and faculty. In fact as I speak, we are announcing the launch of our support of Northern Virginia Community College's SySTEMic Solutions which is a collaborative public – private partnership with the goal of strengthening the STEM pipeline.

By 2018 61% of Idaho's jobs will require postsecondary education and training. The current pipeline does not meet the workforce demand for college-educated workers. Nationally, for every 100 students who go to college and obtain a bachelor's degree, only 19 of them will graduate in a STEM field. These numbers are even worse when it comes to minorities and women.

Getting and keeping students excited about math and science is very important to our company and our foundation's mission. STEM occupations will grow far more quickly than the economy as a whole and will be the second fastest growing occupational cluster. We need a new generation of brilliant engineers, technicians, researchers, and entrepreneurs to create a vibrant future, just as Micron's founders did.

Biography of Ms. Dee K. Mooney

Ms. Dee K. Mooney joined the Micron Technology Foundation, Inc. in 2006 as executive director. Ms. Mooney is responsible for driving the Micron Foundation's global educational and community programs aimed at advancing science and technology education and enhancing the quality of life in Micron's manufacturing site communities. Ms. Mooney collaborates with internal and external partners to develop, maintain, and improve programs as well as develop strong partnerships with community and educational organizations. Micron provides more than $4 million annually to communities and educational institutions globally.

Ms. Mooney previously worked for Albertsons Inc., serving as its director of charitable contributions and community relations. In this role, she also served as vice president of Albertsons Stores Charitable Foundation and president of Albertsons Assist Foundation. Ms. Mooney spent more than seven years with Albertsons, where she held a variety of other positions, including investor relations manager, special projects manager to the CEO and integration analyst.

Prior to Albertsons, she worked for Andersen Consulting as a change management consultant. Ms. Mooney holds a bachelor's degree in psychology from Iowa State University and a master's degree in industrial and organization psychology from University of New Haven.

Mooney serves or has served on the following non-profit boards: Women and Children's Alliance, The Leonardo – Center for Arts and Science, Special Olympics World Winter Games 2009, St. Luke's Health Foundation Board, and St. Luke's Children's Hospital Advisory Board.

The Micron Foundation is a private, non-profit organization established by Micron Technology in 1999 to advance math, science, and engineering in its global site communities. Micron Technology is a worldwide leader in the semiconductor industry.

STATEMENT FOR THE RECORD

BEFORE THE SENATE COMMITTEE ON SMALL BUSINESS AND ENTREPRENEURSHIP

ON

STEM education and the need for American workers to fill the workforce gap that currently exists

ON MAY 22, 2013

Loren Goodman
CTO & Co-Founder InRule Technology

Madame Chair, Members of the Committee, and distinguished panelists,

Thank for you for the opportunity to appear before you today to address an issue very important to my company and many others in the small business technology marketplace: fixing the STEM education pipeline to foster growth in the American software developer workforce.

My company, InRule Technology, is a Chicago-based software company founded in 2002. We have never carried any debt, and have broken even or turned a profit every year. InRule sells a specialized software product that empowers those without technical experience to change the behavior of their enterprise software using natural language. This self-service approach replaces today's arduous process of having to communicate a change to a programming team. Instead, the change can be made directly using the language you already understand. Essentially, it is like going to an ATM as opposed to waiting in line for a bank teller.

We are in a position to grow, but are unable to find the engineering talent we need to do so. We work with multiple recruiters and have an internal bonus system for referrals. Some of the lighter-weight skill sets are not nearly as hard to find, but for the more complex engine side of our product, we need top-of-the-line hard-core programmers that not only understand the algorithms, but have good communication skills and work well in a team setting. Sadly, we cannot find these applicants.

I don't know the exact number of resumes we review, but the ratio of applicants who progress past the preliminary testing and interview stages to those we eventually hire has been about 20 to 1. For the last year that last figure has dropped to zero. This talent deficit has left us with a disproportionate dependence on a small number of individuals. This causes me so much concern that I personally take one of our key engineers to lunch every single time I am in Chicago just to make sure he is happy and not looking at other opportunities. Anything that is bugging him becomes a top priority for me to rectify.

In order to continue as a global leader in technology, our country must find a way to produce more talented software developers and engineers. We cannot continue to rely on foreign labor. It is my belief that to fix the chronic shortage that exists we must make programming literacy a priority for primary and secondary education. We can't expect students to take computer science in college if they've never been exposed to it in high school. Learning to program early in life would help prepare them for rewarding careers in this field, but more importantly it would greatly improve their problem-solving abilities and give them the tools to impact their surroundings in an increasingly connected world.

We currently treat programming as if it is a career choice; students learn to code in pursuit of a career. Instead, I believe, our emphasis should be on learning program to make the technology that surrounds us to do what we want. We don't just teach driving

to people that want to be race car drivers, we teach driving to everyone because it is a common need regardless of their ultimate profession. Making technology do what you want is the same.

Thank you for your time and all the effort you have put into supporting small business. I appreciate the opportunity to address you today and welcome any questions you may have.

Biography of Loren Goodman

Loren Goodman Co-Founded InRule Technology in 2002 and continues to serve as its Chief Technology Officer. InRule sells a unique software product that enables non-technical users to directly manage the logic of an application using the natural language they already understand. Loren is responsible for InRule's technology vision and leading the product development teams to define and develop innovative product features and functionality. He also applies his 20+ years of architecture and development expertise helping InRule clients deliver critical applications. Loren is a regular speaker at industry events and his innovative solutions have been recognized for their forward-thinking approaches and application of technology.

STATEMENT FOR THE RECORD

BEFORE THE SENATE COMMITTEE ON SMALL BUSINESS AND ENTREPRENEURSHIP

ON

BRIDGING THE SKILLS GAP: HOW THE STEM EDUCATION PIPELINE CAN DEVELOP A HIGH-SKILLED AMERICAN WORKFORCE FOR SMALL BUSINESS

ON MAY 22, 2013

NAOMI MONEYPENNY
CHIEF TECHNOLOGY OFFICER & CO-FOUNDER
MANYWORLDS, INC.

Thank you, Madame Chair and members of the Committee.

ManyWorlds is a small high-tech business headquartered in Houston, TX. ManyWorlds is a leader in the field of applying machine learning-based technology to deliver adaptive discovery and personalization solutions for organizations--solutions that enable computer systems to continuously anticipate users' needs rather than just reacting. ManyWorlds' delivers apps and connectors that complement, and integrate across, market-leading enterprise collaborative platforms from companies such as Microsoft and TIBCO. These solutions result in higher performing organizations in which just the right knowledge and expertise are continuously and pervasively delivered to the right people at the right time.

With regard to the skills and talent ManyWorlds has required, and will require even more so going forward, deep applied mathematics and computer science skills are fundamental. Our machine learning-based algorithms are based on creatively using sophisticated mathematical techniques to make quality inferences and wring every last bit of insight from social big data, while also scaling to operate effectively in the largest enterprises and institutions.

As an employer we are challenged to find those skills in the workforce, and even if a suitable candidate is identified, we have to compete for that talent with much larger organizations who can provide many more benefits than a small business. As a woman with a science background, and working in a cutting edge technology field, it has surprised and dismayed me that to-date in our own engineering team that after a decade of business, we do not have any other women on that team. Due to the lack of qualified applicants, we have been forced to both import that talent via immigrant visa programs such as H1B and to offshore part of our engineering team, which has added burden and cost to our operations.

Becoming an innovation leader in the field of enterprise software does not happen overnight. In ManyWorlds' case it required vision, the right skills and talent, and many years of R&D. We are gratified that our persistence and many years of significant investment in R&D have resulted in over a dozen patented inventions in the field of adaptive systems, with many more patents pending.

Our mission is embodied by our tag line, "building learning into the fabric of business," which implies that the computer systems that we all use in our workplaces should automatically learn from us and deliver that learning back to us in ways that make us all smarter and more productive. Our vision has also been embodied in our best-selling book, *The Learning Layer,* which provides an inside view into the technology aspects of designing systems that automatically and pervasively adapt to users' needs, as well as outlining the business and organizational benefits and implications of these technologies. This is the kind of thinking and advances that small technology businesses create--innovating and maintaining US competitiveness.

Our company, ManyWorlds, has only been possible because we as founding entrepreneurs and company leaders have had graduate level-training in STEM fields such as mathematical modeling and astrophysics. Our challenge has been, and will continue to be, finding US-based talent

with STEM backgrounds who can be quickly productive at ManyWorlds, and at an affordable cost.

Naomi F. Moneypenny
Vice President of Research and Media
ManyWorlds, Inc.

Prior to co-founding ManyWorlds in 1998, Ms. Moneypenny served as a senior business and IT strategist at the Royal Dutch/Shell Group –at the time, the most valuable company in the world. At Shell, Ms.Moneypenny developed advanced business strategies for global business units and worked directly with Shell's chairman and other senior executives on overall Shell technology forecasts and knowledge management strategies.

Before moving into the energy industry, Ms. Moneypenny was senior production editor at recognized blue chip business publishing group, Euromoney PLC. At Euromoney, in addition to managing content and redesigning processes across a wide range of business and financial publications, she implemented one of Europe's first Intranets, for which she won the U.K. Director's Award. Ms. Moneypenny uniquely blends a deep understanding of the publishing and media industry, business strategies, and technology strategies and implementation.

Her unusual range of skills and expertise, and experience in working directly with very senior executives makes Ms. Moneypenny a highly sought after and trusted advisor to CXO level executives at Cisco, UBS Warburg, Unilever and Pfizer. She is also often requested as a speaker at executive forums on topics as varied as the strategic implications of globalization to next generation models of the Internet.

Ms. Moneypenny founded and is Executive Editor of www.ManyWorlds.com, the knowledge network of business thought leadership. The knowledge network contains thousands of fresh, high quality and reviewed content, all intelligently integrated. It is also recommended by leading business schools such as Harvard to all of their students, faculty, and alumni, and executives around the world rely on it as a powerful strategic source.

She leads ManyWorlds' development of Epiture®, the innovative software platform that embodies a break-through, patent pending information management paradigm called knowledge network management. Epiture enables the intelligent sharing and syndication of vast networks of content and knowledge, and is currently being used by some of the world's largest companies.

Ms. Moneypenny's formal education includes a graduate degree in Astrophysics from the University of London, as well as executive programs in strategy and M&A from Northwestern's Kellogg School of Management. As a truly global executive and advisor, she is fluent in English and French, and has a strong working knowledge of German, Spanish, Italian and selected Slavic languages.

US Senate Committee for Small Business and Entrepreneurship
STEM Roundtable Discussion – May 22, 2013
Statement by Dr. Shree Taylor, Managing Partner of Delta Decisions DC, LLC

My name is Dr. Shree Whitaker Taylor and I am the Co-Founder and Managing Partner of Delta Decisions of DC. My business focuses on the strategic use of data to solve a broad range of organizational and business needs for federal, state and local governments.

I am formally trained as a computational mathematician with Bachelor and Master degrees from Clark Atlanta University and a PhD from North Carolina State University. As an interdisciplinary scientist, I have had unique opportunities to work alongside biologists, geneticists, pharmacologists and other biomedical scientists while at the National Institute of Environmental Health Sciences (NIEHS/NIH) in Research Triangle Park, NC.

I have also leveraged my mathematical background as an analyst working on various projects in support of national defense while at the Center for Naval Analyses in Alexandria, VA.

As a first-generation college graduate and minority female in a STEM field, I am living proof that there are measurable benefits to establishing and sustaining programs that will provide support for the Women and Minorities targeted in the STEM Booster Act of 2013. Pertinent language from this Bill should be incorporated in the Immigration Reform legislation to ensure that Americans have a fair opportunity to compete for educational and employment opportunities in STEM.

I began my journey as a mathematician unknowingly. I had a clear affinity for mathematics, but no real idea of what I could do with a mathematics degree. I received a five-year scholarship from the Office of Naval Research through Clark Atlanta University to study mathematics and earn my BS/MS in a five year time frame. As I approached graduation and unsure of what I would do next with my life, I followed my mentors' advice and applied for several scholarships and fellowships to pursue my passion. Ultimately, I received a fellowship from the Department of Defense to pursue my PhD at any university in the country. I completed my dissertation at NC State University and found myself at another crossroad.

The collection of random "next steps" I took throughout my education and career were not highly coordinated. I had mentors in place to help guide me, but few programs existed to highlight the nontraditional opportunities that are available to those interested in STEM careers.

As a successful small business owner, I participate in community activities that raise awareness in STEM fields. In particular, since completing the Girls in Excelling in Math and Science (GEMS) Conference where I presented on the many fun opportunities in math, I've had young girls timidly approach me and ask "Are you a mathematician? I remember you from the GEMS Conference!" Their soft voices and big eyes filled with hope affirm for me that I must continue to tell my story and demonstrate that being a real mathematician is attainable.

I wear my "I love math" t-shirt (and other math t-shirts) to the grocery store, while I run errands, to my kids' school and, on occasion, to business meetings to raise awareness. Those in my community know that I love math and that I am a mathematician.

To identify and develop talent within STEM fields, as a best practice framework, I suggest that we follow the DEM model (created by Dr. Michael P. Taylor, Physicist and my husband):

- D = Demystify. Systematically address misperceptions that math and science are too hard or only for nerds.
- E = Expose. Raise awareness of STEM fields and highlight all the fun and relevant opportunities that exist.
- M = Mentor. Create a cadre of STEM talent to provide guidance and support for students in our communities.

Focusing on American Women and Minorities in the STEM Booster Act of 2013 and ultimately Immigration Reform is critical for creating a pipeline of talent and stimulating a vibrant global economy. I'm committed to helping the leaders of our Nation prepare the next several generations of women and minorities in STEM fields.

Biography of Dr. Shree Taylor

Dr. Taylor is a computational mathematician with degrees from Clark Atlanta University (BS/MS) and North Carolina State University (PhD). Her unique interdisciplinary training allows her the ability to collaborate effectively with professionals from fields other than mathematics, while still being an insightful and independent researcher.

Dr. Taylor has worked in the biomedical field as a research scientist at the National Institute of Environmental Health Sciences (NIEHS/NIH) in Research Triangle Park, NC. While there, she developed complex mathematical and statistical models in the areas of cancer and pharmacokinetic research. During her time at NIEHS, she interacted primarily with biologists and other life scientists to develop realistic biological models. This interaction challenged Dr. Taylor to constantly translate highly technical results to non-mathematical audiences at biomedical conferences. Dr. Taylor also spent time as a guest researcher at The German Cancer Research Center in Heidelberg, Germany.

Dr. Taylor has also worked in the field of national defense as a research analyst at the Center for Naval Analyses in Alexandria, VA. Her time there was spent on projects of interest to the Nation's Defense and the interoperability of our military forces. Dr. Taylor designed methodologies for the data collection and development of mathematical models used in analyses, conducted on-site client interviews, and contributed to presentations delivered to top-ranking Navy officials.

As Co-founder and Managing Partner of Delta Decisions, an Operations Research firm that focuses on Analytics, Dr. Taylor formulates creative and innovative solutions to address the client's needs. She has a unique way of listening to clients and extracting critical information that is used to create a logical and systematic plan of attack. Dr. Taylor has the ability to learn new concepts quickly and creatively leverage various resources to complete tasks with integrity and accuracy. She has inspired and led many Delta Decisions project teams and delivered high quality products on time and within budget. Dr. Taylor leads by example and insists on employees producing high quality at all times. Her no-nonsense attitude sets the tone for professional pride in all employees while emphasizing accountability.

Statement of Dr. Shree Taylor
Delta Decisions of DC

My name is Dr. Shree Taylor and I am the Co-Founder and Managing Partner of Delta Decisions of DC. The primary focus of my business is the strategic use of data to solve organizational and business needs for the federal, state and local governments

I am formally trained as a computational mathematician with Bachelor and Master degrees from Clark Atlanta University and a PhD from North Carolina State University. As an interdisciplinary scientist, I have had unique opportunities to work along side biologist, geneticists, pharmacologists and other biomedical scientists while at the National Institute of Environmental Health Sciences (NIEHS/NIH) in Research Triangle Park, NC. I have also used my mathematical background as an analyst working on various projects in support of national defense while at the Center for Naval Analyses in Alexandria, VA.

I am interested in sharing my perspective as a first-generation college graduate and minority female in a STEM field.

US Senate Committee for Small Business and Entrepreneurship
STEM Roundtable Discussion Follow Up– May 28, 2013
Statement by Dr. Shree Taylor, Managing Partner of Delta Decisions DC

My name is Dr. Shree Whitaker Taylor and I am the Co-Founder and Managing Partner of Delta Decisions of DC. My business focuses on the strategic use of data to solve a broad range of organizational and business needs for federal, state and local governments. I received my PhD in Applied Mathematics from North Carolina State University.

On Wednesday, May 22, 2013, I joined Senator Mary Landrieu at a roundtable discussion on "*Bridging the Skills Gap: How the STEM Education Pipeline Can Develop a High-Skilled American Workforce for Small Business*". During our discussions, Senator Landrieu asked that we document our perspectives on the best and fastest way to address our Nation's skill gaps as it pertains to high-skilled, technical workers.

The deficit of high-skilled, technical workers our Nation faces should be met with a short and long-term strategy. During the roundtable, we focused on a number of long-term strategies, most of which focus on establishing partnerships. However, our Nation needs a scalable short-term solution to address the immediate need.

To address the skill gap for high-skilled workforce, I recommend that we implement a competency–based model (CBM) solution. The CBM solution is based on the premise that the technical skills required for an advanced technical position can be taught if specific fundamental skills are already in place. For example, if a technical position requires competencies related to innovation, initiative, thoroughness, decisiveness or conceptual thinking, then the company would select and hire candidates with those basic behavior indicators. Then, the company would train the new-hire to perform the specific technical tasks associated with a particular position.

This model is applicable at the pre- and post-secondary school level. We can assess students at an early age and for those that demonstrate a high competency in technical fields, provide them with a blueprint or roadmap for becoming a high-skilled worker in the United States. For most students, a competency assessment will provide them with a sense of direction and purpose.

The competency model would outline specific behavior and technical competencies that are required to perform the job well. However, more attention would be given to the behavior competencies than the technical competencies. Behavior competencies tell us who an individual is at the very core. It divulges their internal barometer for the skill sets associated with high performing technical workers. If designed properly, the competency model would reveal if an individual is "wired" to perform well in certain technical areas or not.

Because individuals grow and change as they get older, conducting an "update" competency assessment will be useful to see if students have maintained their technical skills or if their technical skills have become more balanced with other non-technical, soft skills. The ultimate goal is to help guide students and a young workforce into the right field by offering supportive programs and a nurturing culture that complements their interests.

In order for this framework to be a success, the educational system and/or companies must be willing to invest in our human capital; current and future. If a collection of pioneering companies would invest in developing a customized competency model for a technical workforce, then we could identify early on those individuals who have an interest in and a talent for highly skilled technical positions. Furthermore, companies could build upon these models based on their own corporate requirements. Developing a competency model specific to their needs, would allow a more precise and targeted recruiting and selection process. With the proper consultation, the corporate competency model could be tailored to systematically identify candidates with the right skill set for positions that require highly skilled employees.

Once the individual has been identified, the company would immediately enroll the new-hire in a development program geared at increasing the aptitude of the new-hire in a specific field that is of value to the company. Because the development program would be in a focused area of knowledge, the training could be limited to a period of three (3) to twelve (12) months. During that time, the new-hire would develop specialized skills at or beyond the required position set forth by the company.

A high skilled workforce exists here in our Nation, as we have some of the world's best technical universities and students. Short-and long-term solutions to the immediate need of high-skilled workers lies in continued education where companies invest in their human capital through a revised recruiting and selection process that is based on competencies.

Statement For The Record

Senate Committee on Small Business and Entrepreneurship

Bridging the Skills Gap: How the STEM Education Pipeline Can Develop a High-Skilled American Workforce for Small Business.

May 22, 2013

Rose Wang
Founder & CEO
Binary Group

I would like to thank Senator Landrieu and other Members of the Committee for the opportunity to be a part of this roundtable. I am here as an executive advisory board member of Women Impacting Public Policy (WIPP), and I also wear several other hats. In my capacity as a business owner and a first generation immigrant who came to the US to fulfill my dreams 23 years ago, I support comprehensive immigration reform with a balance of building America's skilled worker bench, especially in the STEM fields.

I hope to bring my perspective as the CEO of a mid-tier government technology consulting firm as well as a council member for National Women's Business Council (NWBC), and a past director on the board of Women in Technology, where I helped to develop the Girls in Technology program.

Yesterday as I was driving to work, I heard about two young women who recently won Intel Science competitions with their own innovations:

Sara Volz, who investigated increasing the oil content of algae to create an economically viable source of biofuel, received the top award at the Intel Science Talent Search 2013. The 17-year-old Colorado native built an algae farm under her lofted bed. Her long-term goal, she has said, is to understand the universe.

Eesha Khare won a $50,000 scholarship for inventing a supercapacitor that can charge a cell phone in about 20 seconds. Her invention beat about 1,600 young scientists who competed in the Intel International Science and Engineering Fair.

I love to hear inspirational stories like these. Much like these young scientists and engineers, I had an interest in science, math and technology from an early age. I was taking algebra in 4th grade, calculus in 7th grade, and started computer programming at age 13. China's education culture fostered my passion for science and math at an early age, but I wanted to come to the US to be able to have many more career choices and opportunities.

I was one of the lucky ones to get a visa to the US. I protested with nearly a million other college students in Tiananmen Square in 1989, and after the June 4, 1989 massacre, I had difficulty getting to the US. When the Senate passed the Chinese Students Protection Act in 1990, it allowed me to come to the U.S., where I pursued and earned my Master's Degree in Computer Science from University of Houston.

My early career took me to Silicon Valley where I helped a start-up company develop a cutting-edge tool for software designers. After a successful exit of the company, I launched my first IT consulting company. Subsequently, I worked in two more start-up companies, one of them was my own Dot Com.

After 9/11, I felt compelled to contribute to my adopted country by applying commercial technology best practices honed from my technology consulting company to help Federal Government agencies. In 2002, Binary closed its first contract with the US Army, working with DynCorp. Today, we are an award-winning firm providing our defense and federal clients technology solutions for their transformational initiatives.

Because we are a defense contractor, one of our primary issues is the need for a more efficient way to clear staff. The government wants to support small businesses, yet we had to wait many months to get employees cleared, sometimes leaving positions unfilled.

The H-1B program is not relevant to my company, but it matters to me personally. I have friends and family who consider it a lottery system. They apply every year, only to get rejected because the quota is reached. More importantly, the H-1B program is a short-term fix to building a skilled bench for US economy.

Building a pipeline in the US of STEM students to fulfill positions in the future is no small feat. Supporting young girls and boys to study STEM fields needs to start at an early age. Once teens reach high school, it's too late.

Small businesses like mine need to compete effectively by hiring highly skilled workers to fulfill client requirements for technology and engineering projects. So I urge the Congress to move the STEM Booster Bill forward to support these efforts now. With regards to my work specifically, I ask this Committee and other relevant Committees to consider how we can speed up the clearance process so we can fulfill current contract requirements. Finally, I ask Congress to continue with the aims of this roundtable, and support building the STEM pipeline, so small and large businesses can hire skilled workers from the United States.

Rose Wang,Founder and Chief Executive Officer

Rose Wang, founder and Chief Executive Officer of Binary Group, guides the overall corporate vision and strategy for the company. Ms. Wang has successfully moved Binary from its initial position as an IT and advisory services company to an Outcome Driven firm that delivers results quickly and cost-effectively for Federal customers. Aligning market needs with Binary's offerings, Ms. Wang continues to drive the company's sales within mission-critical practice areas.

Ms. Wang has been instrumental in charting Binary's transformation strategies and developing its unique methodology - **Outcome Driven Enterprise ApproachTM**. She continually propels the company to produce better results, accelerating time to value for customers. Binary has experienced tremendous growth and success under her leadership, while delivering billions of dollars of savings and value for customers.

Ms. Wang is a highly regarded IT strategist and entrepreneur. She was a pivotal engineering team member for Lighthouse Design, a Silicon Valley startup company, leading the development of an object-oriented software analysis and design tool for the enterprise Java market. After a successful early acquisition of Lighthouse by Sun Microsystems, Ms. Wang launched an IT consulting company, Binary Consulting, securing contracts from Fortune 500 companies, including MCI, Fannie Mae and Sprint.

Ms. Wang joined the venture-backed start-up InLine Software as their Chief Architect, leading product development of enterprise software systems. At the same time, Ms. Wang founded an online women's business community, iBizWomen.com.

In 2000, Ms. Wang refocused Binary Group, landing a major contract with Cable & Wireless. After 9/11, Ms. Wang steered the company in a new direction, bringing her commercial experience and enterprise architecture and system development success to the Federal Government. Under her direction, Binary closed its first contract with the Army, working with DynCorp Information System's Defense CFT. Ms. Wang spearheaded the initial technology solutioning team in developing software architecture for a major defense logistics system. Ms. Wang led Binary's business development efforts to expand business within the Army quickly, and secure new contracts with the Army and DoD CIO offices and many other Federal clients, due to her passion to deliver results quickly and cost-effectively.

Ms. Wang is actively involved in many organizations, speaking frequently on matters specific to technology, business growth strategies, entrepreneurship, and government contracting. Ms. Wang is a mentor for entrepreneurs and aspiring business leaders, supporting the advancement of women and minorities. Binary Group graduated from the 8(a) program and Ms. Wang currently mentors an 8(a) company as part of the DoD mentor protégé program.

Ms. Wang is a thought leader on small business issues as well as government procurement policies. As one of the 15 Council Members of the National Women's Business Council, a non-

partisan federal advisory council created to serve as an independent source of advice and counsel to the President, Congress, and the SBA on economic issues of importance to women business owners, Ms. Wang actively participates in the research and policy committee advocating for fairness in small business procurement practices.

Ms. Wang is a current board member of the Association for Enterprise Information, a division of the National Defense Industrial Association (NDIA), and on the executive advisory board for Women Impacting Public Policy (WIPP). She was a past member of the board of directors for Association of Corporate Growth - National Capital Region and Women in Technology. Ms. Wang has been recognized numerous times throughout her career for her leadership, policy, mentor, and business accomplishments.
Ms. Wang earned her Master's Degree in Computer Science from University of Houston and a Bachelor of Science and Bachelor of Arts from Beijing Polytechnic University.

June 6, 2013

The Honorable Mary L. Landrieu
Chairwoman
Committee on Small Business & Entrepreneurship
United States Senate
428A Russell Senate Office Building
Washington, D.C. 20510

Dear Chair Landrieu:

It was a privilege appearing before your Committee to share the experiences and challenges my software development company faces in the search for qualified programmers. At the close of the roundtable, panelists were offered the opportunity to provide suggestions of how to alleviate the problem of STEM worker scarcity. Attached is a one-page description outlining an innovative solution to the difficulties small businesses face navigating the H-1B process. I hope this proves helpful.

Thank you again for the opportunity to address the Committee. I welcome any questions you may have about this proposal or any other matters relating to small business technology companies. I would also commend to you the Association for Competitive Technology (ACT) as a resource on small business software issues. ACT has long been helpful to my company and has assisted me in the delivery of this submission while I am unavoidably away from the office due to an urgent family matter.

Best regards,

Loren Goodman
Founder, CTO
InRule Technologies, Inc.

CC: The Honorable James Risch

Loren Goodman, Chief Technology Officer, InRule Technology, Inc.
Proposal to Alleviate Small Business Challenges to H-1B Applications

At the close of the Senate Small Business Committee's STEM workforce panel, Chair Mary Landrieu asked panelists for ideas that could have an immediate impact to alleviate the STEM worker deficit. Tens of thousands of STEM jobs went unfilled last year and the talent gap reduces our GDP and ability to compete globally. It is essential in the long run to invest in our education system to produce enough graduates that we can rely on a homegrown developer workforce. That will take time, however, and we need to fill these openings now or companies like mine will not be able to grow.

The problem with the H-1B option for small businesses is the process is cumbersome, confusing, and inconvenient. Larger companies are at a scale where it is cost effective to develop and maintain internal expertise for the H1B visa process and ongoing compliance. Smaller companies spend more time and money per application due to their unfamiliarity with the process and need to hire outside counsel. A solution to help smaller companies meet the challenges of finding the skilled workers they need to grow their businesses would be to simplify the H-1B application process.

The Immigration Smart Portal:
The H1B process for a sponsor company is more difficult than it needs to be. It primarily involves a series of narrative communications along with a limited number of forms and documents that must be filled out and submitted. Due to the complicated nature and expected precision of those communications, to avoid costly mistakes, small companies generally rely on outside counsel to handle the process.

An innovative solution could be to provide small businesses the option to use a TurboTax-type online form submission. In the same way that millions of Americans file their taxes electronically with programs that automate the process, an H-1B applicant could use software that guides them through a series of questions and prompts for submissions. This Q&A process would ultimately glean enough detail to auto-populate whatever applications, communications, and documents are required.

Specifically, an applicant would be asked a series of questions about the job they are looking to fill; provide details about their company; and describe efforts to find a qualified American applicant. Upon submitting the required information, the applicant may be informed that they have satisfied "initial eligible criteria." Additional questions become more detailed and, depending on the answers, further questions may ensue or supporting documents may be required for submission. Upon completion of this Q&A process, the applicant reviews the auto-generated application letter along with a manifest of what documents must be submitted uploaded or mailed.

An automated submission process like this would be much easier for small businesses and would simplify and standardize the information immigration officials would receive.

Introductory Statement of
David S. North, Fellow, Center for Immigration Studies,
Washington, D.C.,

at the Roundtable on
"Bridging the Skills Gap: How the STEM Education Pipeline Can Develop a High-Skilled American Workforce for Small Business"
Committee on Small Business & Entrepreneurship
United States Senate
May 22, 2013

While I am pleased and honored to be asked to join this discussion, I am not at all sure that there is a "skills gap" to be "bridged."

The title of the roundtable suggests that the "gap" is a fact. It is not.

It is a concept that has been manufactured by some elements in big business who argue that America would grow faster if it had virtually unlimited access to alien workers with degrees in Science, Technology, Engineering, and Math. (There is, of course, absolute silence about how much money this will save such thunderously prosperous entities as Apple.)

It is also a concept much more closely linked to immigration issues that to a discussion of support for education in the STEM fields.

Do we see Intel and IBM and the Indian outsourcing companies rallying to a subsidy to help Americans studying STEM subjects by paying off their student loans?

Similarly, do we see these firms leading the drive to get more American women into the STEM fields; or to recruit more domestic minorities to study these subjects?

More significantly, do we see sharply rising wage rates in STEM, something that routinely happens in markets when there is a gap between supply and demand?

Well, no, none of those things are happening and you would expect ALL of them to be going full blast were there a real "skills gap."

What we do see is a full court press from big business to bring more foreign skilled workers to the U.S. We see that the big computer-related firms have persuaded the Gang of Eight in the Senate to expand the supply of nice, docile and relatively inexpensive foreign workers with some high tech skills by increasing the ceilings for nonimmigrant workers (in the H-1B program) and by offering an unlimited number of permanent visas (green cards) to aliens who have completed master's or doctor's STEM degrees in this country.

What we need, Madame Chairman, is for all the massive energies and funds currently being used to try to change the immigration law to be channeled instead to the support of your bill, S. 288, "Women and Minorities in STEM Booster Act of 2013."

# # #

UNITED STATES DEPARTMENT OF LABOR
Employment & Training Administration

TRADE ADJUSTMENT ASSISTANCE COMMUNITY COLLEGE AND CAREER TRAINING GRANT PROGRAM (TAACCCT)

The purpose of this program is to provide eligible institutions of higher education with funds to expand and improve their ability to deliver education and career training programs that can be completed in two years or less, and that result in skills, degrees, and credentials that prepare program participants for employment in high-wage, high-skill occupations, and are suited for workers who are eligible for training under the Trade Adjustment Assistance for Workers program, under Chapter 2 of Title II of the Trade Act.

The Department of Labor is implementing this program in partnership with the Department of Education. TAACCCT is authorized by the Trade Act of 1974 under Chapter 4 of Title II.

FUNDING

The TAACCCT Grant Program is funded under the Health Care and Education Reconciliation Act of 2010, which appropriated $500 million for the program for each of Fiscal Years 2011-2014, for a total of $2 billion.

In FY 2013, the total amount of funds available is approximately $474 million as a result of the sequestration required by the Balanced Budget and Emergency Deficit Control Act of 1985 (Pub. L. 99-177), as amended.

ELIGIBLE APPLICANTS

Any institutions of higher education, as defined in Section 102 of the Higher Education Act of 1965 (20 U.S.C. 1002), which offers programs that can be completed in not more than two years are eligible to apply. These include public, proprietary, or other nonprofit educational institutions. Generally, such institutions of higher education include 2-year and 4-year colleges and universities, Historically Black Colleges and Universities, Tribally Controlled Colleges and Universities, Hispanic-serving Institutions, and Asian American and Native American Pacific Islander-serving Institutions.

The Department intends to fund grants ranging from $2,372,500 to $2,750,000 million to single institution applicants, for 54 to 63 grants totaling up to $150 million across 50 states, the District of Columbia, and Puerto Rico. The Department will also award grants up to $25 million to single-state or multi-state consortium applicants, totaling approximately $324 million that propose programs that will impact TAA-eligible workers and other adults across a state, region or regions, industry sector or cluster of related industries.

TAACCCT Round One and Round Two Combined Grant Totals

Dollars Rounded

2.5 Million
2.5 to 10.0 Million
10.0 to 20.0 Million
20.0 to 40.0 Million

Round One resulted in 49 grants ranging from $2.5 million to $5 million for individual applicants and from $2.5 million to $20 million for consortium applicants.

The grant awards in the Round Two competition included 27 grants ranging from $2.5 million to $3 million each for individual applicants, 27 grants ranging from $5 to $15 million each for single and multi-state consortium applicants, and 25 state-designated grants of $2.5 million each. In total, 79 grants, representing close to 300 institutions of higher education, were awarded funds either as single applicants or as the lead institutions of single and multi-state consortia.

A complete list of the grant awards and project summaries can be found on the TAACCCT website at:

http://www.doleta.gov/taacct/grantawards.cfm.

THE FY 2013 TAACCCT GRANT COMPETITION IS OPEN!

For more information on how to apply and to download the solicitation for grant application, please visit us at http://www.doleta.gov/taacct or email us at taacct@dol.gov.

TAACCCT
TRADE ADJUSTMENT ASSISTANCE COMMUNITY COLLEGE AND CAREER TRAINING GRANT PROGRAM

CompTIA

May 21, 2013

The Honorable Mary L. Landrieu
Chairwoman
U.S. Senate Committee on Small Business and Entrepreneurship
428A Russell Senate Office Building
Washington, DC 20510

The Honorable James Risch
Ranking Member
U.S. Senate Committee on Small Business and Entrepneurship
428A Russell Senate Office Building
Washington, DC 20510

Dear Chairwoman Landrieu and Ranking Member Risch,

On behalf of the Computing Technology Industry Association (CompTIA), thank you for hosting a Full Committee Roundtable on "Bridging the Skills Gap: How the STEM Education Pipeline Can Develop a High-Skilled American Workforce for Small Business." We are committed to helping bridge the skills gap that our country is currently facing. As members of the high-tech community, we see this gap first hand everyday and are grateful for the attention that you and your colleagues are bringing to this matter.

As you may know, CompTIA is a non-profit trade association representing the IT industry. Our over 2000 members are at the forefront of innovation and provide a critical backbone that supports broader commerce and job creation. These members include computer hardware manufacturers, software developers, technology distributors, and IT specialists that help organizations integrate and use technology products and services. CompTIA is also the leading developer and provider of vendor-neutral IT workforce certifications, including A+, Security+ and Network+.

According to the career website Burning Glass, as of May 2013, the number of open IT job postings in the United States is nearly 300,000. Unfortunately, there is no silver bullet that we can use to address the skills gap that is causing these jobs to remain unfilled. Very often the conversation around STEM focuses on advanced degrees; and yet many of the 300,000 open IT jobs do not require PhDs in STEM. While it is true that improved STEM education at the K-12 level can help drive young people toward an advanced degree, it is also the case that that a solid STEM foundation can lead to good paying, long term IT jobs based on degrees from two- and four-year institutions and/or after having obtained industry recognized, portable, stackable credentials.

We wanted to bring two CompTIA studies to your attention that address the skills gap issue. The first is entitled, "State of the IT Skills Gap" and was released in February 2012. The second is entitled, "Youth Opinions of Careers in IT" and was released in May 2012. We hope that you will find both of these reports useful for your discussion.

For your future reference, CompTIA Research and Market Intelligence provides timely, relevant data and insights aimed at furthering the understanding of IT industry and workforce trends. CompTIA has a library of over 100 research reports, whitepapers, videos and webinars, with new material produced each month. Using rigorous research techniques, CompTIA collects data from tens of thousands of end-users and IT companies on a wide range of issues covering tech trends, channel dynamics and the IT workforce. CompTIA Research and Market Intelligence is routinely cited in major news outlets, presented at conferences and used by organizations of all types. We are happy to provide you with any of these materials at your request.

Again, thank you for your commitment to this issue. We are committed to and look forward to working with you and your staffs to improve the STEM education pipeline in order to reduce the skills gap. Please do not hesitate to contact us if we can be of assistance.

Best,

Randi Parker

Randi Parker
Director, Public Advocacy

CompTIA

YOUTH OPINIONS OF CAREERS IN INFORMATION TECHNOLOGY

RESEARCH

MAY 2012

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About this Research

CompTIA's *Youth Opinions of Careers in Information Technology (IT)* study explores what young people think about a job in the information technology industry and the prospects of considering a career in IT. It also looked at the factors that might influence their decisions about a career in the IT arena and the role that schools and other career information sources play in this decision.

This study consists of the following sections:

Section 1: Background
Section 2: Technology Drives the Information Economy
Section 3: More Career Choices, More Decision Factors
Section 4: Careers in Information Technology (IT)
Section 5: Factors Influencing Career Interest
Section 6: Appendix with Additional Data Tables

CompTIA designed this study, analyzed the data and prepared all reporting deliverables. Data collection was outsourced to the research firm, ORC International Inc. The data was collected via an online survey conducted among a national sample of 1002 teens and young adults. The sample breaks down as follows: 503 teens in the 13-17 age range, comprising 252 boys and 251 girls; and 499 young adults in the 18-24 age range, comprising 249 boys and 250 girls. The survey was conducted March 27-April 2, 2012.

Respondents for this survey were selected from among those who have volunteered to participate in online surveys and polls. Because the sample is based on those who initially self-selected for participation, no estimates of sampling error can be calculated. If the study had a truly random sampling frame, margin of sampling error at 95% confidence for the aggregate results would be +/- 3.2 percentage points.

As with any survey, sampling error is only one source of possible error. While non-sampling error cannot be accurately calculated, precautionary steps were taken in all phases of the survey design, collection and processing of the data to minimize its influence.

CompTIA is responsible for all content contained in this series. Any questions regarding the study should be directed to CompTIA Market Research staff at research@comptia.org.

CompTIA is a member of the Marketing Research Association (MRA) and adheres to the MRA's Code of Market Research Ethics and Standards.

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Key Points

- As "digital natives" today's teens and young adults have been immersed in technology since day one. CompTIA research confirms a true love affair, with a 97% (NET) of teens and young adults reporting to love/like technology.

- Teens are more than just technology consumers – 58% frequently serve as technology facilitators, helping family members or friends with questions or troubleshooting problems with computers, software, mobile devices or related technologies. An additional one-third of respondents report providing "tech support" services at least occasionally.

- Love of and aptitude with technology doesn't always translate to career interest. A relatively low 18% of teens and young adults report a definitive interest in a career in information technology (IT). More encouragingly, a much larger segment of "maybes," exists (43%). Many respondents in the study acknowledge not knowing enough about IT occupations, which may help explain the apparent disconnect.

- Interest in specific areas of information technology were highest for videogame design, mobile app development and web development.

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Background

Throughout its history, the U.S. economy has been one of the most dynamic economic environments in the world. Harnessing ingenuity, allocating resources and efficiently deploying labor are just a few of its hallmarks.

The economy has seen many changes over time, including the profound shift from a manufacturing focus to a services focus. More recently, indicators point to another distinct period in economic history – the emergence of the 'information economy,' also referred to as the 'knowledge economy,' the 'digital economy' or even the 'creative economy.' As the name implies, an information-based economy is built on a foundation of digital information and driven by digital interactions facilitated by the Internet.

As with any relatively new trend, the information economy is an evolving concept. While there are certain defining characteristics associated with the information economy, such as building value through network effects, there are still fuzzy areas, as well as overlaps with manufacturing and service elements.

The consultancy McKinsey & Company pegs the global information economy, which they refer to as the Internet economy, at $8 trillion. Additionally, McKinsey calculates the Internet economy accounted for 21% of GDP growth for mature economies over the past five years. Arguably, this is only the tip of the proverbial iceberg though, since the technologies and processes associated with the digital era have affected every sector of the economy in some way.

In addition to contributing to economic growth, McKinsey estimates the Internet has created 2.6 jobs for every job it displaced. This suggests opportunities for workers with the right combination of education, skills and experience.

While education has always been important to economic success, both at a macro level and a personal level, in a knowledge-based economy, the importance increases exponentially. Unemployment data from the U.S. Bureau of Labor Statistics shows a perfect correlation between education attainment and employment.

2011 Unemployment Rates by Education Level

14.1%	Less than high school diploma
9.4%	High school diploma
8.7%	Some college, no degree
6.8%	Associate degree
4.9%	Bachelor's degree
3.6%	Master's degree
2.4%	Professional degree
2.5%	Doctoral degree

Furthermore, the Pew Research Center estimates a bachelor degree will on average earn a worker $1.42 million over a 40-year career, compared to $770,000 for a high school graduate. That $650,000 difference narrows somewhat, to $550,000, according to the analysis, after factoring in the expenses of going to college and the four years of potential earnings that college graduates give up while they are in school. This doesn't necessarily imply 4-year college is for everyone, but it does suggest that some form of career and technical education (CTE) provides a significant boost in a knowledge-based environment.

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Technology Drives the Information Economy

The microprocessor recently celebrated its 40th birthday. This invention went on to spur one of the most innovative periods in history. Over the decades, increasingly powerful and affordable computing, inexpensive mass storage, more expansive broadband coverage, new form factors and greater know-how to put it all together have had a significant impact on the economy and society.

For most of the population, the speed and magnitude of change has been nothing short of remarkable.

For recent generations, however, the digital era is not an emerging trend but rather simply the status quo. Whereas previous generations have had to learn or "un-learn" and part ways with legacy technologies before adopting new technologies, Gen Y and Gen Z (aka "digital natives") have been immersed in the technologies of the digital era since day one.

While there is certainly overlap between Gen Y and Gen Z in how they view and experience the world, one key difference does exist. Segments of Gen Y can still remember the pre-digital days, while Gen Z does not know a world without ubiquitous computing, communications, Internet and all things digital.

Generational Cohort	Birth Dates*	Notable Technologies During Teen Years**
Gen Z (aka Digital Natives)	1995 – 2011	Smartphones, Apps, Tablets, GPS, Flat Panel Displays, Facebook, Texting, Skype, Mobile Video, "On-Demand Everything," The Cloud
Gen Y (aka Millennials)	1982 – 1994	DVD, MP3 Players, HDTV, Digital Cameras, Cell Phones, Laptop PCs, Broadband, Email, TiVo, Satellite TV, Google, Sony PlayStation, YouTube
Gen X	1965 – 1981	VCR, Sony Walkman, CD Players, Cable TV, Cordless Telephones, Pagers, Microsoft Windows 2.0/3.0 Nintendo, Netscape
Baby Boomers	1946 – 1964	Color TV, Hi-Fi stereo systems, 8-Track, Pocket Calculators

**Opinions differ on the cohort age ranges; for the purposes of this paper, the above ranges will be used*
***There is much overlap between cohorts; the technologies cited are meant to give the reader an idea of what a "typical" member of the cohort may have experienced during their teens years; it is not meant to be an all-inclusive or precise listing of technology release dates.*

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CompTIA's study confirms the overwhelmingly positive views of technology held by teens and young adults (aka Gen Y and Gen Z). A nearly ubiquitous 97% (NET) report loving/liking technology. For the purposes of this study, technology was positioned as a sampling of products ranging from computers and smartphones to tablets, the Internet and apps. *Note: this survey used an online data collection methodology. While Internet penetration and access rates in the U.S. are very high (>80%), inevitably, small segments of the target teen and young adult population were not reachable. Consequently, the segment of "non-connected" teens and young adults likely has a different view of technology than the connected population – something to keep in mind when interpreting the results.*

Just to further put Gen Y and Gen Z's love of technology into context, a 2011 study by Gartner found that 46% of driving-age members of these cohorts prefer access to the Internet over access to a car. In contrast, only 15% of Baby Boomers prefer access to the Internet over access to a car. It wasn't that long when one of the most significant rights of passage for a teenager was getting a drivers license. According to the U.S. Department of Transportation, only 30% of 16-year-olds had acquired a driver's license in 2010, down from a rate of 50% in 1978. Technology has truly changed the mindset and behaviors of a generation of teens and young adults.

Teens and Young Adults Love Technology

		Age		Gender	
Relationship with Technology	**Total**	**13-17 years**	**18-24 years**	**Boys**	**Girls**
Love technology	74%	73%	74%	82%	65%
Like technology	23%	23%	23%	16%	30%
Technology is just okay	3%	4%	2%	2%	4%
Dislike technology	0%	0%	1%	0%	0%

Note: for this question, technology was positioned was encompassing products such as computers, software, apps and mobile devices.

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Base: Total 1002 respondents, 13-17 years=503, 18-24 years=499, Male=501, Female=501

Advancing the Global IT Industry

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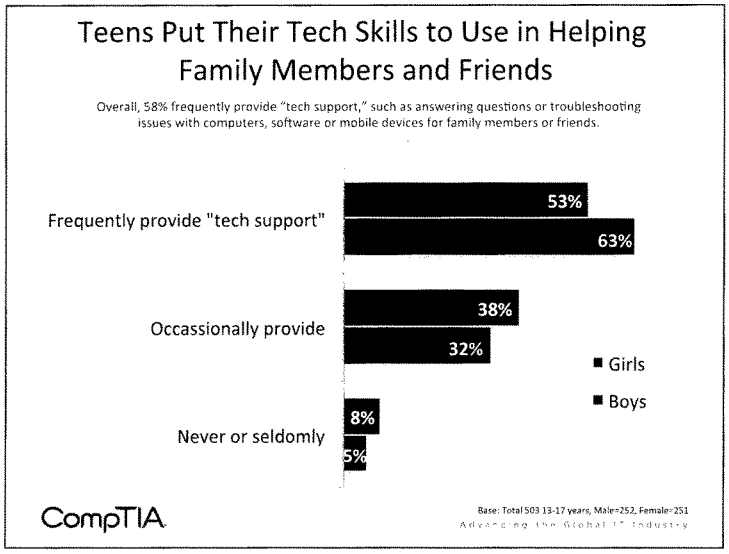
The research indicates teens are more than just technology consumers. More than half of respondents in the CompTIA study report frequently serving as a facilitator of technology, helping family members or friends with questions or troubleshooting problems with computers, software, mobile devices or related technologies. An additional one-third of respondents report providing "tech support" services at least occasionally.

Many teens and young adults probably don't realize the value of the technical skills they are developing through their efforts in assisting family members. In the information economy, technical literacy is a prerequisite for many occupations, even beyond technology positions.



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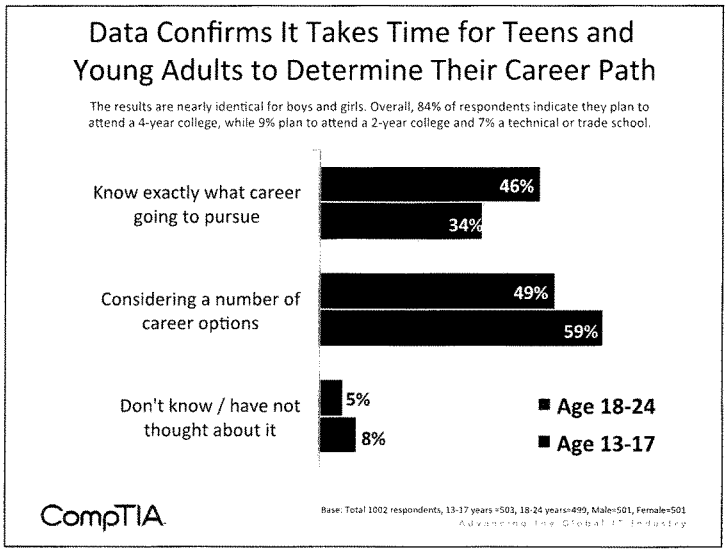
More Career Choices, More Decision Factors

Today's teens and young adults recognize the importance of post-secondary training and education. According to the results of this CompTIA study, 4 out of 5 students indicate they hope to pursue a 4-year college education. Slightly more girls than boys express interest in this route. About a tenth plan to attend 2-year colleges and 7% plan to attend a technical or trade school.

Of course, not every student will be able to follow through on their pursuit of education due to economic or life events, but many sources of data confirm the upward trend of post-secondary education enrollment. According to U.S. Census data, in 2011 45% of those 18-24 were enrolled in some type of post-secondary program, up from 31.3% in 1990. The Pew Research Center attributes some of the increase to economic factors (e.g. education is an attractive alternative to unemployment), as well as the increase in community college enrollment.

With more career choices than ever, teens and young adults face a bewildering set of options. Entirely new occupational categories have risen from the information economy, such as mobile app developer, digital content curator, ethical hacker, big data analyst, just to name a few. Of course, some job categories and some industries have contracted because of the pressures exerted by the digital economy, so employment opportunities for young people in some areas have been lost.



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Of the 1.6 million bachelor's degrees conferred in 2008–09, 46% were earned in four primary fields.

Highest Concentration of College Degrees by Field of Study
Source: National Center of Education Statistics

1. Business – 348,000 degrees
2. Social sciences and history – 169,000 degrees
3. Health sciences – 120,000 degrees
4. Education – 102,000 degrees

Top 10 College Majors by Average Hourly Wage: 2012
Source: Wall Street Journal analysis of U.S. Census data

1. Economics – $43.15
2. Electrical Engineering – $41.61
3. Mechanical Engineering – $40.43
4. Finance – $38.21
5. Mathematics – $37.76
6. Accounting – $36.88
7. Computers & IT – $35.83
8. Political Science – $33.32
9. Marketing – $32.90
10. Business Management & Administration – $31.56

Note: students that select certain undergraduate majors often pursue an advanced degree. For example, biology majors may go onto medical school, or political science majors to law school. Consequently, this can affect the interpretation of average wage data.

According to the U.S. Department of Education, annual prices for undergraduate tuition, room and board at private institutions averaged $32,184 for the 2009-2010 academic year, while public institutions averaged $12,804. Consequently, it's not uncommon for newly minted graduates to hold more than $100,000 in loans. According to New York Times analysis of Department of Education data, 94% of students pursuing a bachelor's degree now borrow money to pay for their education, up from 45% in 1993.

Further complicating the situation, the cost of education continues to outpace inflation and wages. During the 10-year period 1999-2009, undergraduate tuition, room, and board at public institutions rose 37%, and prices at private institutions rose 25%, after adjustment for inflation.

Projected Changes in Occupation Growth: 2010-2020
Source: U.S. Bureau of Labor Statistics Occupational Outlook

- 14% All occupations
- 22% Computer occupations (NET)
  - 31% Database administrators
  - 30% Software developers
  - 28% Network and computer system administrators
  - 22% Computer systems analysts
  - 22% Information security analysts, web developers and computer network architects
  - 19% Computer and information research scientists
  - 18% Computer support specialists
  - 12% Computer programmers

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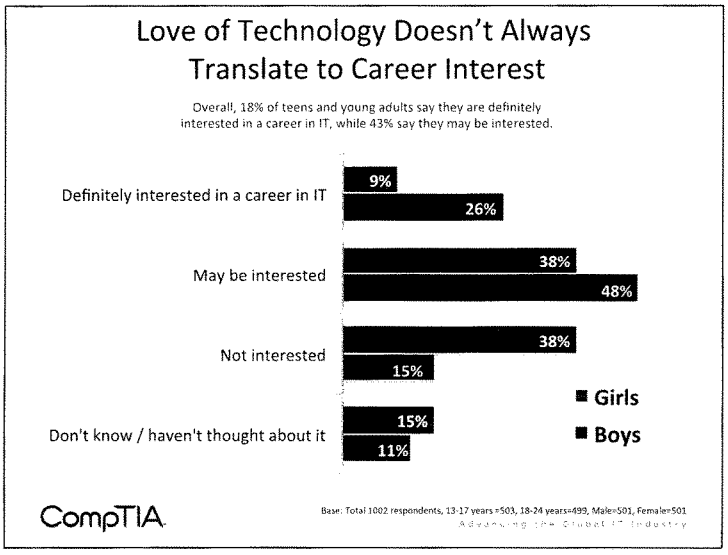
Careers in Information Technology (IT)

Careers in information technology (IT) can take many forms and can be approached from many directions. U.S. businesses across every industry sector employ more than 3.6 million workers in core IT positions. Add in peripheral technology workers and the figure is substantially higher. And yet, U.S. universities produce relatively few computer science graduates – 11,000 in 2011. This figure is up over 2010, but still below the peak of 22,000 degrees conferred from several years ago. A recent New York Times article speculated the movie *The Social Network,* about Mark Zuckerberg and the creation of Facebook, has provided a bump in the "cool factor" of IT and could be a contributing factor in the slight increase in college students pursuing computer science degrees.

The gap between computer science degrees and information technology workers indicates many workers acquired the necessary skills to succeed in IT through other means. This may have entailed community college, an advanced degree in a computer field, on-the-job training or self-study. Unlike some fields such as the legal field where there is essentially one or two career paths, information technology careers have many entry points.

CompTIA research shows a relatively small pool of students with definitive interest in a career in IT, but a much larger pool of "maybes." This seems consistent with the level of uncertainty surrounding careers in general at that stage in life.



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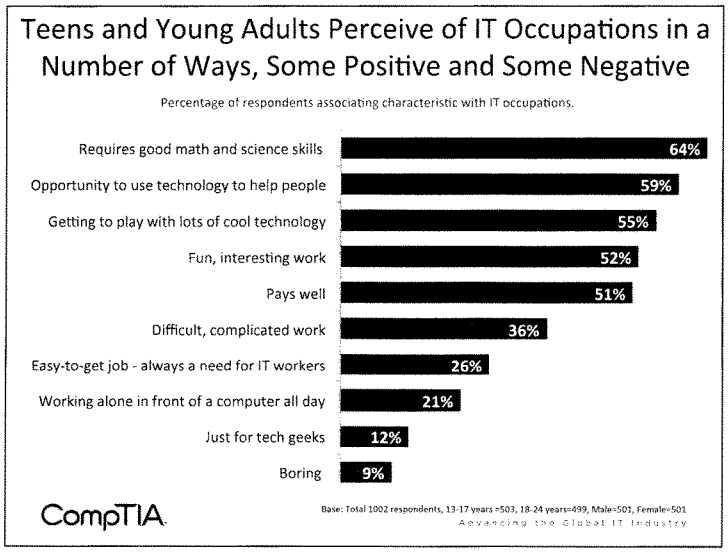
An analysis of perceptions of information technology (IT) careers reveals some positives and some negatives. Students see a strong relationship between certain IT careers and an aptitude for math and science. Interestingly, more respondents perceived of IT careers as an opportunity to help people than an opportunity to earn a large paycheck or engage in fun or interesting work.

Additionally, only 26% of respondents believe IT occupations are in demand, which is unusual given the low unemployment rate for IT workers and the approximately 300,000 information technology job openings as of April 2012, according to the job board aggregator Indeed. This may reflect a feeling of cynicism towards the job market in general. Many young people have seen parents or relatives laid off, or they themselves may have struggled finding a part-time or summer job.

Other perceptions include the belief that IT work is difficult or complicated, while 1 in 5 students associate IT with working alone (see *Appendix* for data segmentations). In some cases, IT work is indeed incredibly complex, or may require intense concentration while writing code. But, it's sometimes easy to overlook the vital creative, collaborative and problem solving elements of technology work, as well as the diversity of occupations within the field.



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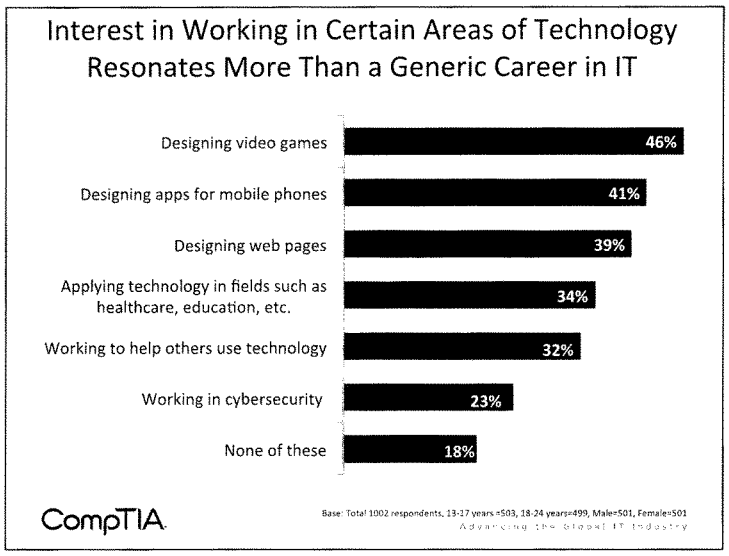
When presenting specific areas within information technology, teens and young adults express much stronger interest. At the top, nearly half of the respondents could see themselves potentially designing video games, while 41% could envision creating apps for mobile devices. Video game design was especially high among boys, with an interest rate of 69%. Conversely, girls showed relatively more interest in web design (40% vs. 38% for boys).

Clearly, specific examples of information technology occupations resonate more than a generic reference to IT.



Top of Mind Associations* with the Information Technology (IT) Industry Among Teens and Young Adults

- Apple
- Microsoft
- Dell
- Google
- IBM
- Sony
- Geek Squad
- HP
- Intel
- Best Buy

Other firms receiving multiple mentions: AT&T, Verizon, Cisco, ITT Tech, Yahoo

**Unaided verbatim responses among 1002 boys and girls in the 13-24-age range.*

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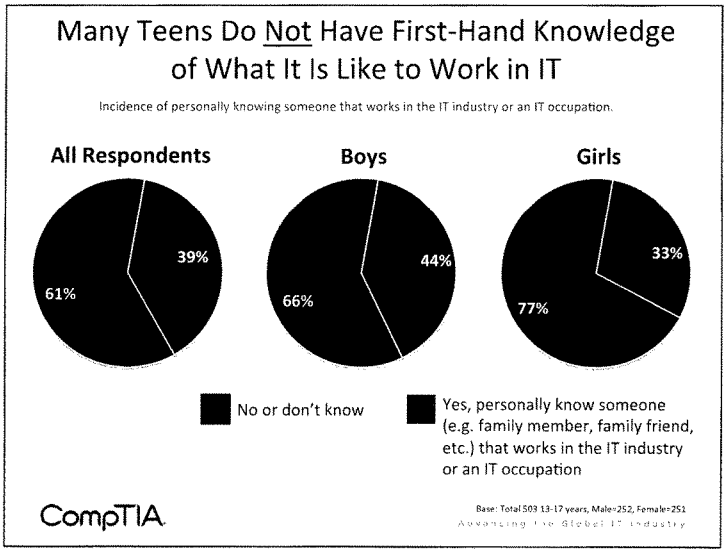
Factors Influencing Career Interest

Certain occupations, such as teacher, doctor or plumber, are generally well understood. Ambiguity reigns for most occupations though. Jobs in management, engineering, marketing, research, finance, IT and the catch-all, consulting, can be confusing even to co-workers. Even though most students have a sense of what their parents or relatives do for a living, the reality is, few truly understand the day-to-day work of any given occupation.

CompTIA research indicates about 4 in 10 teens personally know a family member, relative or family friend that works in information technology. Among those that do know someone, it's likely most have only a vague idea of what that person does at work.

Lack of IT role models must be considered, but it probably shouldn't be weighted too heavily. Ask any teen to name a famous technology personality and they will likely mention Steve Jobs, Mark Zuckerberg or Bill Gates. Ask them to name a famous doctor, lawyer or investment banker and they will likely struggle (Dr. Phil and Judge Judy do not count).

Information technology has more "celebrities" than most professions, but that may not translate to as much understanding of the profession as one may suspect. According to the data, lack of familiarity with the IT field is cited by teens and young adults as a primary factor contributing to low interest in the career path (see chart on following page). This knowledge gap exists for boys and girls at about the same rate.



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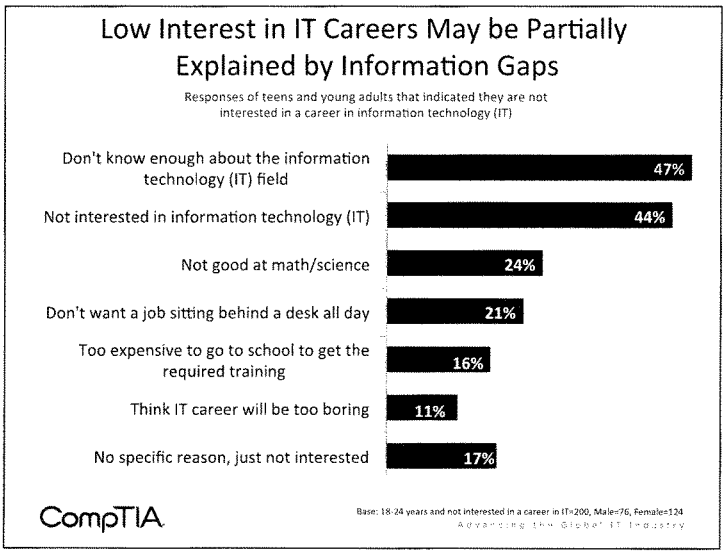
The other primary reason for a reluctance to consider an IT career is a general lack of interest in the field of information technology. This factor rates especially high among girls (53% vs. 28% for boys).

As noted previously, the data confirms teenage boys and girls love technology, many are power users helping family members, and many express interest in specific areas of technology such as mobile app design. And yet, 44% indicate a lack of interest in the field of information technology. Unfortunately, there is no obvious answer to explain the disconnect.



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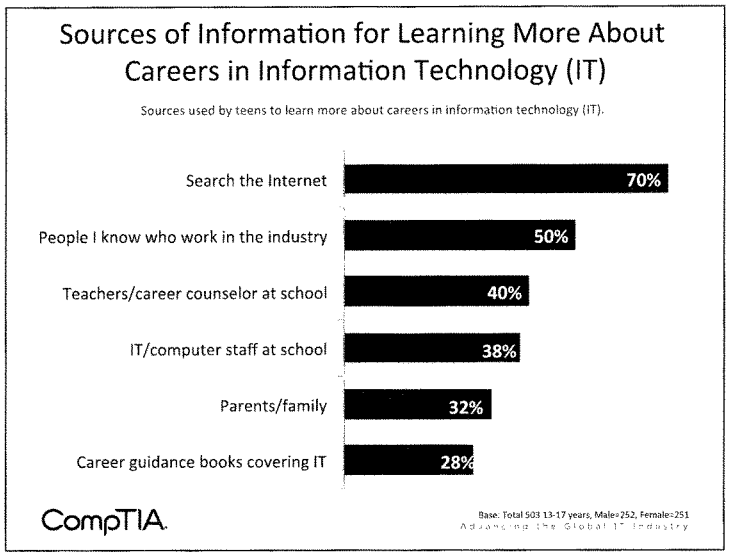
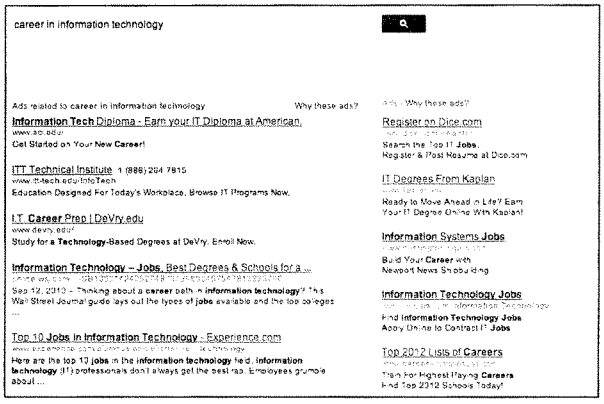
As expected from "digital natives," the Internet is the starting point for anything and everything. Seventy percent of students cite Internet search as a primary tactic for gathering career information. The career guidance books of the days of old have been nearly rendered obsolete.



Students conducting a Google Search on May 4th, 2012 would have seen the following listing of information and advertisements (see *Appendix* for more details).



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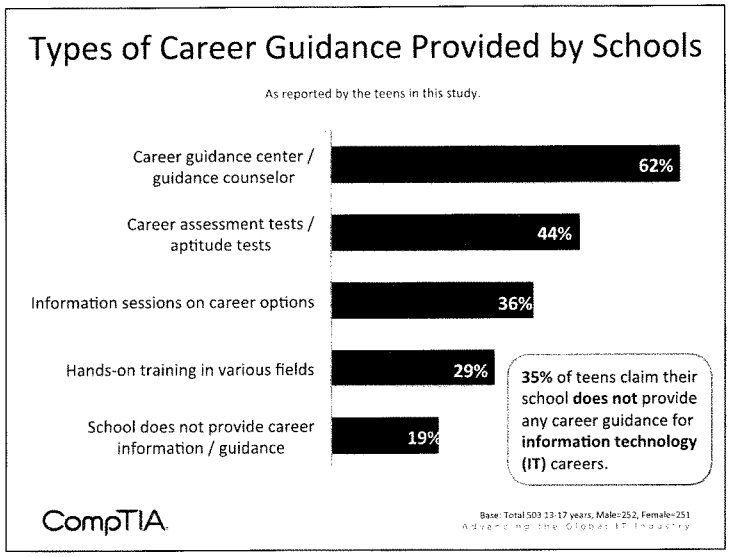
School-provided career services act as the complement to student self-serve efforts. Only 62% of students believe their school has a guidance counselor or career center, which seems low. It could be a function of some students not interacting with the career center and therefore underreporting its presence. Then again, given the cuts to school budgets on the heals of the recession (nearly $2 billion for K-12 schools in 2011 according to the National Association of State Budget Officers), it's quite possible some schools have reduced or eliminated guidance counselors and career centers.

When asked specifically about career guidance for the IT field, 65% of students report having access to this type of information at their school. Again, there could be some underreporting from students that have not yet used their school's career guidance services and are unfamiliar with what is available or not.



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Appendix

4-Year College is Still the Expected Next Step for the Vast Majority of Students

Future plans	Total	Gender	
		Boys	Girls
Attend a 4-year college	84%	77%	90%
Attend a 2-year college	9%	10%	8%
Attend a technical or trade school	7%	10%	4%
Get a job	21%	23%	20%
Go into the military	6%	9%	3%
Don't know / Haven't thought about it	5%	7%	2%

Note: some respondents may have selected multiple options, such as getting a job and attending school part-time.

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Base: Total 503 13-17 years, Male=252, Female=252

Interest in a Career in Information Technology (IT)

Interest in a career in IT	Total	Age		Gender	
		13-17 years	18-24 years	Boys	Girls
Definitely interested in	18%	15%	20%	26%	9%
May be interested in	43%	46%	40%	48%	38%
Not interested in	27%	27%	26%	15%	38%
Don't know / Haven't thought about it	13%	12%	14%	11%	15%

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Base: Total 1002 respondents, 13-17 years =503, 18-24 years=499, Male=501, Female=501

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Perceptions of Working in IT Occupations by Segment

What describes a job in IT	Total	Age		Gender	
		13-17 years	18-24 years	Boys	Girls
Requires good math and science skills	64%	65%	62%	64%	64%
Opportunity to use technology to help people	59%	58%	60%	59%	59%
Getting to play with lots of cool technology	55%	53%	56%	55%	55%
Fun, interesting work	52%	52%	52%	57%	48%
Pays well	51%	50%	52%	54%	47%
Difficult, complicated work	36%	34%	39%	32%	41%
Easy-to-get - always a need for IT workers	26%	24%	28%	28%	23%
Working alone in front of a computer all day	21%	20%	21%	15%	28%
Just for tech geeks	12%	13%	11%	10%	14%
Boring	9%	11%	7%	4%	14%

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Base: Total 1002 respondents, 13-17 years =503, 18-24 years=499, Male=501, Female=501

Interest in Working in Specific Areas of Information Technology (IT)

Interest in specific areas of IT	Total	Age		Gender	
		13-17 years	18-24 years	Boys	Girls
Designing video games	46%	50%	42%	69%	23%
Designing apps for mobile phones	41%	41%	41%	43%	38%
Designing web pages	39%	40%	38%	38%	40%
Working to apply technology to help people in areas such as healthcare, education	34%	33%	35%	38%	30%
Working to help others use technology, such as answering their questions or fixing their computer problems, etc.	32%	31%	33%	40%	24%
Working in cybersecurity to help protect users/companies from viruses, hackers, etc.	23%	22%	25%	30%	17%
None of these	18%	19%	18%	9%	27%

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Base: Total 1002 respondents, 13-17 years =503, 18-24 years=499, Male=501, Female=501

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Reasons for Not Considering a Career in IT

Reasons for not considering a career in IT	Total	Gender	
		Boys	Girls
Don't know enough about the information technology (IT) field	47%	46%	48%
Not interested in the field of information technology (IT)	44%	28%	53%
Not good at math/science	24%	24%	23%
Don't want a job sitting behind a desk all day	21%	21%	21%
Too expensive to go to school to get the required training/qualifications	16%	22%	12%
Career in IT will be too boring	11%	8%	13%
No specific reason, just not interested	17%	20%	15%

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Base: 18-24 years and not interested in a career in IT=200, Male=76, Female=124

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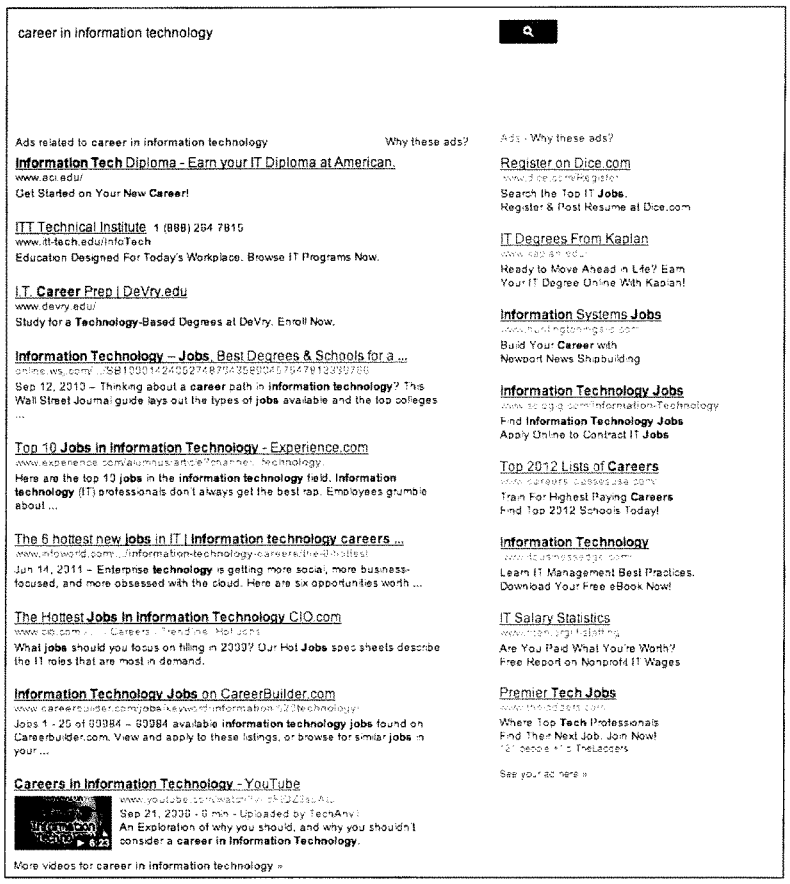
Students cite Internet search as a primary tactic for gathering career information. Students conducting a Google Search on May 4th, 2012 will see the following sources of information and advertisements.



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STATE OF THE IT SKILLS GAP

FULL REPORT

FEBRUARY 2012

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About this Research

CompTIA's *State of the IT Skills Gap* study was conducted to gain a better understanding of the IT skills in demand and identify any existing or forthcoming IT skills shortages. The objectives of this research include:

- Identify which IT skills are and will be most important to employers
- Determine how well IT staff skills align with current/future needs of employers
- Examine professional development practices

The study consists of three sections, which can be viewed independently or together as chapters of a comprehensive report.

Section 1: Background
Section 2: IT Skills Gap Causes and Trends
Section 3: Addressing IT Skills Gaps

The data for this study was collected via a quantitative online survey conducted December 15, 2011 to January 23, 2012 among 1,061 IT and business managers involved in managing IT or IT staff within their organizations. The countries covered in this study include: Canada (n=125), Japan (n=109), South Africa (n=75), United Kingdom (n=250), and the United States (n=502).

The enclosed material covers the U.S. portion of the results ONLY. The international results are presented in a separate report.

The margin of sampling error at 95% confidence for aggregate results is +/- 2.9 percentage points. For the U.S. segment of the survey, margin of sampling error is +/- 4.3 percentage points. Sampling error is larger for subgroups of the data. As with any survey, sampling error is only one source of possible error. While non-sampling error cannot be accurately calculated, precautionary steps were taken in all phases of the survey design, collection and processing of the data to minimize its influence.

CompTIA is responsible for all content contained in this series. Any questions regarding the study should be directed to CompTIA Market Research staff at research@comptia.org.

CompTIA is a member of the Marketing Research Association (MRA) and adheres to the MRA's Code of Marketing Research Standards.

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STATE OF THE IT SKILLS GAP

SECTION 1: BACKGROUND

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Section 1 – Key Points

- The importance of information technology to the success of companies is growing.
- Relatively few organizations report being exactly or even very close to where they want to be with technology utilization and staff skill levels.
- The top IT priorities for U.S. companies still include security, data storage, refreshing aging equipment, improving network infrastructure, and disaster recovery/business continuity. Consequently, even with the core areas of technologies, new options translate to the need for new skills.
- Beyond core IT, the emerging areas of business process automation, mobility, collaboration, virtualization and a host of other technologies will be priorities for segments of companies. Again, each of these emerging areas will require both IT staff and end users have sufficient knowledge bases and skill sets to maximize the return on technology investment.

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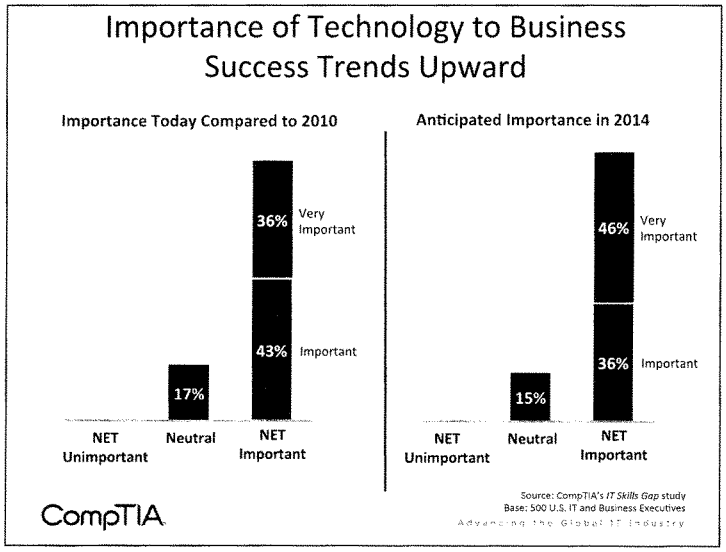
Technology Drives Business Success

The past few years have been an incredible period in innovation. Increasingly powerful and affordable computing, inexpensive mass storage, more expansive broadband coverage, new form factors and greater know-how to put it all together have had a significant impact on the economy and society.

Technology now affects more businesses in more ways than ever before. From SMBs to large enterprises and capital-intense industries to labor-intense industries, technology routinely sits at the center of business strategy.



The data reveals a few nuances to the technology importance ratings. Large firms place higher levels of importance on technology compared to smaller firms: 44% very important rating for large firms (500+ employees) vs. 33% for small firms (25-99 employees) and 30% for micro firms (5-24 employees). And, as expected, companies in the IT industry vertical place more importance on technology than companies in other verticals. But even in the case of the latter, a super majority rate technology as very important or important to their success.

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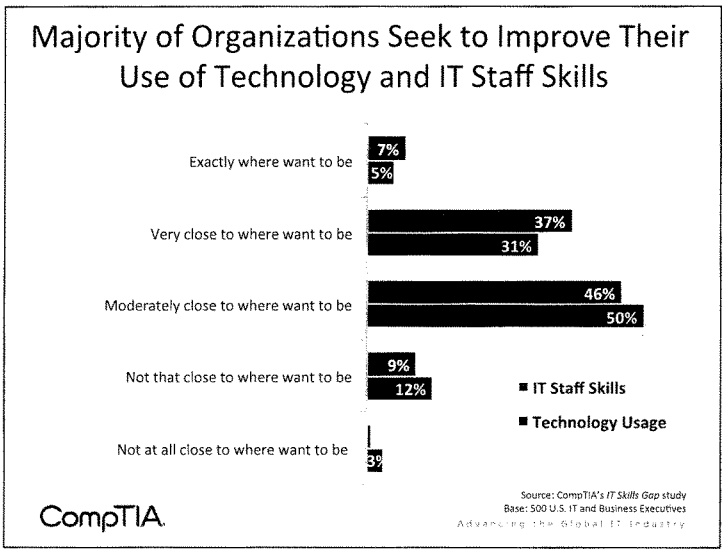
Many Organizations Not Where They Want to Be with Technology / Staff Skills

Despite the acknowledgment of technology's importance to business success, relatively few organizations are where they want to be in their use of technology. Some of this can certainly be attributable to the resource constraints facing just about every organization. Even in good times, there is never enough budget to buy every sought after piece of hardware or software.

Beyond the investment itself, challenges in execution is the other major reason many organizations are not where they want to be in their use of technology. Failure to execute can take many forms. It could be a poor purchase decision – buying the wrong technology for the wrong job. It could be a poorly executed deployment, where new technology does not optimally integrate with legacy technology. Or, it could be a failure to adapt management, business processes or company culture. Few organizations are truly agile; most must overcome hefty inertial forces to change directions. Lastly, it could be a function of knowledge and the ability to apply that knowledge to business needs.

According to the research, relatively few organizations report being exactly or even very close to where they want to be with technology utilization and staff skill levels. To put this in perceptive, according to the U.S. Economic Census there are approximately 27 million businesses in the United States (employer + non-employer businesses). The 65% of organizations rating their technologically utilization at moderately close or lower represents nearly 18 million businesses. Additionally, it translates to over 15 million businesses that rate the aggregate skill level of their IT staff as less than optimal. Even modest improvements in these two areas could yield tremendous economic benefits.



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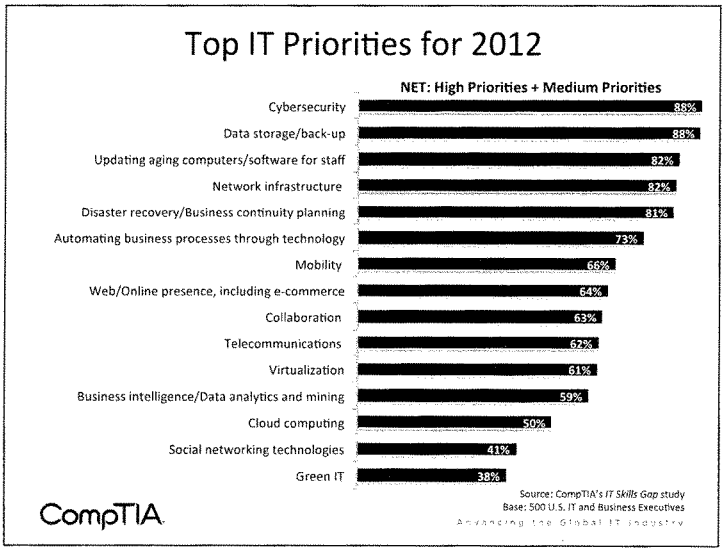
IT Priorities Provide Clues to Knowledge and Skill Needs

The top five IT priorities for U.S. companies today probably look a lot like priorities that may have been published five or even ten years ago. Core issues of security, data storage, refreshing aging equipment and networks have been mainstays of IT departments since the advent of IT departments. Of course, there are now new variables that make decisions regarding core elements slightly more complicated. On-premise or cloud? In-house staff or outsource? Open source or proprietary technology? And the list goes on. Consequently, even with the core areas of technologies, new options translate to the need for new skills.

Beyond core IT, the emerging areas of business process automation, mobility, collaboration, virtualization and a host of other technologies will be priorities for segments of companies (see chart on accompanying page). Again, each of these emerging areas will require both IT staff and end users have sufficient knowledge bases and skill sets to maximize the return on technology investment.

Note: given the hype surrounding cloud computing, it may seem inconsistent for it to be rated a relatively low priority in this study. Keep in mind, that many of the top-tier priorities may involve a cloud element. For example, a company needing data storage and disaster recovery may evaluate the options and settle on a cloud-based solution. Others seeking business process automation may implement a cloud-based software-as-a-service option such as SuccessFactors for HR employee management. The take-away: many CIOs and business executives first think about the problem/needs and then the solution, which in some cases will inevitably involve a cloud element.



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Top Ten IT Priorities by Company Size

NET: High Priorities + Medium Priorities

Micro Firms (5-24 employees)
91% Data storage/back-up
87% Cybersecurity
78% Network infrastructure
77% Updating aging computers/software
76% Disaster recovery/Business continuity
73% Web/Online presence, including e-commerce
71% Business process automation
67% Mobility
63% Collaboration (e.g. web/video conferencing)
60% Business intelligence/Data analytics and mining

Small Firms (25-99 employees)
86% Updating aging computers/software
85% Data storage/back-up
85% Cybersecurity
80% Disaster recovery/Business continuity
80% Network infrastructure
70% Business process automation
67% Web/Online presence, including e-commerce
63% Mobility
56% Collaboration (e.g. web/video conferencing)
52% Telecommunications (e.g. VoIP, UC)

Medium Firms (100-499 employees)
90% Cybersecurity
87% Data storage/back-up
84% Network infrastructure
82% Updating aging computers/software
82% Disaster recovery/Business continuity
73% Business process automation
67% Virtualization
66% Telecommunications (e.g. VoIP, UC)
65% Collaboration (e.g. web/video conferencing)
61% Mobility

Large Firms (500+ employees)
92% Cybersecurity
89% Data storage/back-up
89% Disaster recovery/Business continuity
87% Network infrastructure
86% Updating aging computers/software
81% Business process automation
79% Virtualization
76% Telecommunications (e.g. VoIP, UC)
75% Business intelligence/Data analytics and mining
74% Mobility

Source: CompTIA's *IT Skills Gap* study
Base: 500 U.S. IT and Business Executives

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Methods Organizations Use to Manage the IT Function

Managing the IT function	Micro Firms	Small Firms	Medium Firms	Large Firms
Formal IT department with dedicated IT staff	35%	50%	87%	87%
Informally with other staff that are not part of a formal IT department	42%	41%	28%	21%
Occasional use of an outside IT firm/tech consultant for specific projects or work	39%	39%	41%	42%
Outsourcing of a function via an on-going contract with an outside IT firm (managed IT services)	22%	15%	15%	25%

Micro firm = 5-24 employees
Small firm = 25-99 employees
Medium firm = 100-499 employees
Large firm = 500+ employees

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Source: CompTIA's *IT Skills Gap* study
Base: 500 U.S. IT and Business Executives

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STATE OF THE IT SKILLS GAP

SECTION 2: IT SKILLS GAP CAUSES AND TRENDS

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Section 2 – Key Points

- The great majority of employers (93%) indicate there is an overall skills gap, the difference between existing and desired skill levels, among their IT staff.
- Nearly 6 in 10 (56%) companies report being only moderately close or not even close to where they want to be with IT skills.
- Respondents place the highest levels of importance on skills associated with what could be described as the IT foundation such as networks, servers, storage, security, database management, and IT support.
- Most (80%) organizations indicate their IT skills gap affects at least one business area such as staff productivity (41%), customer service / customer engagement (32%), and security (31%).
- Nearly half of respondents cite the dynamic nature of the tech space as a primary cause of skills gaps. Another top cause is the lack of resources for professional development.

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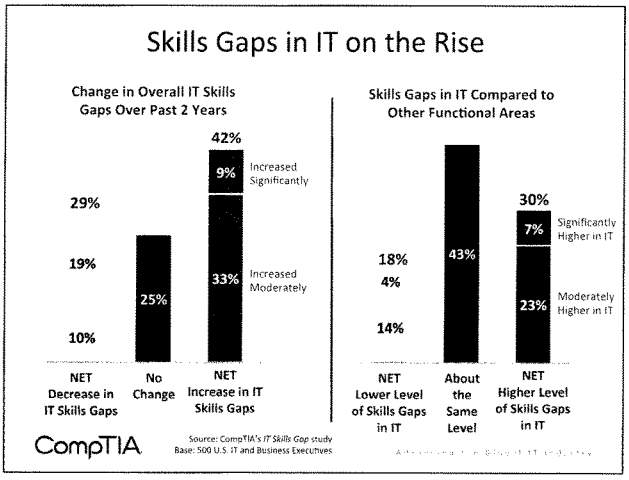
IT Skills Gaps Trend Upwards

It would be challenging, and somewhat troublesome, to find an organization that is perfectly content with the level of skills and expertise their employees possess. Couple that with today's unforgiving competitive environment and the skills needed to effectively support ever-changing technology, an overarching gap in IT skills is no surprise. As the data in CompTIA's *State of the IT Skills Gap* study echoes, a vast majority of employers (93%) indicate there is an overall skills gap, the difference between existing and desired skill levels, among their IT staff. Unfortunately, nearly 6 in 10 companies report being not close or only moderately close to where they want to be with IT skills. The distribution of results aligns with where the organization lies on the technology usage curve (see Section 1). In other words, gaps in IT skills are likely hindering companies' optimal utilization of technology and presumably hampering business success.

On a more positive note, at least some companies are making headway with their gaps in IT skills as 3 in 10 employers feel the IT skills gap at their organization has decreased over the past two years, which may be a function of their industry vertical, their IT needs or even the effectiveness of their internal training initiatives. Alternatively, it could be a situation of "not knowing what you don't know." Some organizations could be unaware of their IT skill needs, especially in emerging areas.

Nonetheless, few differences exist in comparisons of the data by company size, industry vertical or job role. This suggests widespread self-awareness and recognition of the issue.

Compared to other functional areas, such as marketing, finance, operations and so forth, 30% of executives believe skills gaps are more prevalent in IT. Validating the importance of industry-specialization skills, this percentage is considerably higher for those in the IT industry (40%) versus organizations outside IT such as government, education, finance, retail, healthcare, manufacturing (non-IT products), and other sectors (26%).



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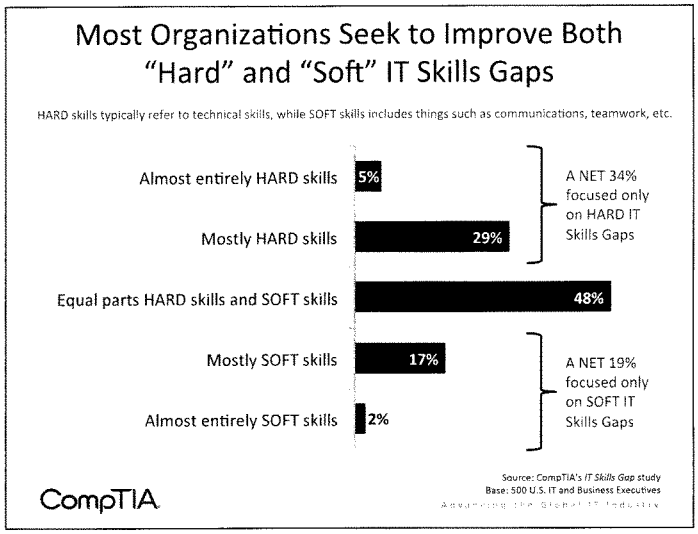
Most Organizations Seek to Improve Both "Hard" and "Soft" IT Skills Gaps
HARD skills typically refer to technical skills, while SOFT skills includes things such as communications, teamwork, etc.
Almost entirely HARD skills
5%
Mostly HARD skills
29%
A NET 34% focused only on HARD IT Skills Gaps
Equal parts HARD skills and SOFT skills
48%
Mostly SOFT skills
17%
Almost entirely SOFT skills
2%
A NET 19% focused only on SOFT IT Skills Gaps
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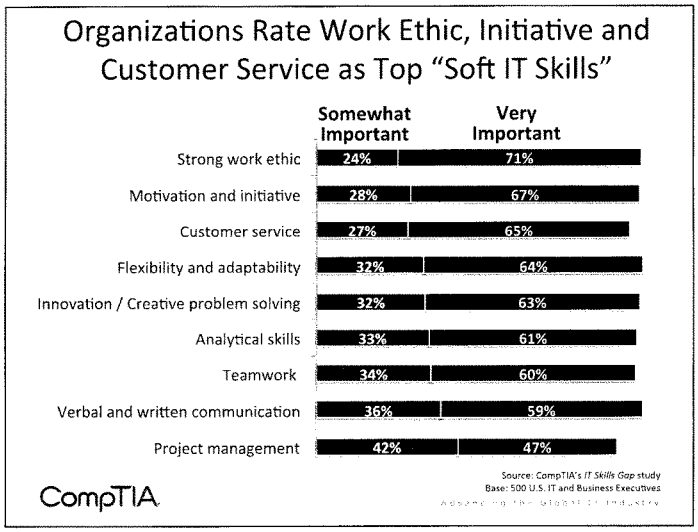
Source: CompTIA's IT Skills Gap study
Base: 500 U.S. IT and Business Executives


Organizations Rate Work Ethic, Initiative and Customer Service as Top "Soft IT Skills"
Somewhat Important
Very Important
Strong work ethic
24%
71%
Motivation and initiative
28%
67%
Customer service
27%
65%
Flexibility and adaptability
32%
64%
Innovation / Creative problem solving
32%
63%
Analytical skills
33%
61%
Teamwork
34%
60%
Verbal and written communication
36%
59%
Project management
42%
47%
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Source: CompTIA's IT Skills Gap study
Base: 500 U.S. IT and Business Executives

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Analysis of IT Skills Needs and Gaps

In most organizations, strategic priorities align with and influence IT skills needs. Core IT priorities, as well as longer-term priorities in emerging areas (see Section 1), are reflected in skills ranking. Respondents place the highest levels of importance on skills associated with what could be described as the IT foundation – the fundamental elements of hardware, software and IT support required to exist in today's digital economy.

Top Tier IT Skills Priorities (NET rating of >70%)

- Networks / Infrastructure
- Server / data center management
- Storage / data back-up
- Cybersecurity
- Database / Information management
- Help desk / IT support
- Telecommunications / Unified communications
- Printers, copiers, multifunction devices
- Data analytics / Business intelligence
- Web design and development
- Customer relationship management (CRM)

Beyond core IT skills, needs vary based on a number of factors. For example, skills associated with mobile device management received an overall net rating of 60%, which places it as a mid-level need. Given the eye-popping adoption figures of mobile devices, a mid-tier skills need rating may seem questionable. However, there are a lot of variables at play. A company with a customer base in a limited geographic range that relies heavily on internal sales and third party fulfillment may need only the very basics from mobile devices, such as voice communication and email.

In many disciplines, importance ratings are similar across firm type, such as small vs. large or IT industry vs. non-IT industry. Notable differences do exist though (see tables on subsequent pages).

Summary of Notable Differences in IT Skills Importance Ratings:

Larger Firms

- Place relatively more importance on IT skills associated with virtualization, SharePoint, ERP, big data, cybersecurity, telecom and A/V

Smaller Firms

- Place relatively more importance on IT skills associated with search engine optimization

IT industry Firms

- Place relatively more importance on IT skills associated with big data, application development/programming, web design/development, mobile app development, Linux and cloud computing

Non-IT industry Firms

- Place relatively more importance on IT skills associated with telecom, printers/copiers and A/V

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Rating of Importance of IT Skills | Concern Over Skills Gaps	Skill Somewhat Important	Skill Very Important	NET Importance of Skill	Skills Gap Concern
Infrastructure / End-points				
Networks / Infrastructure (LANs, WANs, etc.)	30%	65%	95%	40%
Server / data center management	32%	61%	93%	38%
Storage / data back-up	35%	57%	92%	29%
Help Desk / IT support	35%	51%	86%	28%
Telecommunications - VoIP, UC, etc.	44%	35%	79%	21%
Printers, copiers, multifunction devices	46%	33%	78%	17%
Mobile phones / smartphones	39%	21%	60%	21%
A/V - projectors, digital displays, etc.	37%	11%	49%	11%
Tablets	32%	12%	44%	21%
Information				
Security / Cybersecurity	32%	59%	91%	40%
Database / Information management	38%	51%	89%	40%
Data analytics / Business intelligence	45%	27%	72%	27%
Customer relationship management (CRM)	41%	30%	71%	22%
Enterprise resource planning (ERP)	45%	18%	63%	22%
"Big data" (Hadoop, NoSQL, etc.)	34%	12%	46%	14%
Applications / Internet				
Web design / development	40%	31%	71%	29%
SQL	36%	34%	70%	20%
HTML	41%	28%	70%	13%
Web infrastructure	41%	28%	69%	20%
Virtualization	33%	36%	69%	26%
Application development / programming	32%	34%	67%	21%
SharePoint	39%	18%	57%	18%
Search engine optimization (SEO)	38%	19%	57%	18%
JavaScript	39%	18%	57%	11%
Java	38%	18%	56%	11%
Cloud computing - SaaS related	37%	15%	51%	20%
Mobile app management, development, etc.	34%	16%	50%	14%
Cloud computing - IaaS or PaaS related	36%	14%	50%	21%
PHP	34%	11%	45%	9%
Linux	28%	15%	43%	14%
Apple devices / OS / iOS	30%	13%	43%	13%

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Index of IT Skills Rated Very Important	Micro Firms	Small Firms	Medium Firms	Large Firms	IT Firms	Non-IT Firms
Infrastructure / End-points						
Networks / Infrastructure (LANs, WANs, etc.)	74	108	116	110	105	98
Server / data center management	79	107	110	112	102	99
Storage / data back-up	90	107	104	102	104	99
Help Desk / IT support	79	86	128	116	110	97
Telecommunications - VoIP, UC, etc.	74	87	131	117	78	108
Printers, copiers, multifunction devices	89	114	112	86	67	112
Mobile phones / smartphones	115	89	104	86	106	98
Tablets	81	81	113	136	102	99
A/V - projectors, digital displays, etc.	58	59	158	143	68	111
Information						
Security / Cybersecurity	83	86	112	127	108	97
Database / Information management	92	94	98	120	110	97
Customer relationship management (CRM)	105	98	94	102	120	93
Data analytics / Business intelligence	90	74	97	149	112	96
Enterprise resource planning (ERP)	46	81	111	189	113	95
"Big data" (Hadoop, NoSQL, etc.)	66	77	124	151	164	77
Applications / Internet						
Virtualization	69	85	113	149	122	92
Application development / programming	87	81	109	132	141	85
SQL	80	89	123	118	132	89
Web design / development	106	96	101	94	129	90
HTML	104	89	112	92	116	94
Web infrastructure	86	106	108	105	134	88
Search engine optimization (SEO)	123	105	77	87	126	91
SharePoint	46	74	130	177	99	100
Java	75	50	136	156	141	85
JavaScript	97	46	134	129	144	84
Mobile app mgt, development, etc.	89	112	95	108	135	88
Linux	76	90	122	122	150	82
Cloud computing - SaaS related	97	94	98	113	172	74
Cloud computing - IaaS or PaaS related	109	84	99	107	146	84
Apple devices / OS / iOS	123	77	101	92	120	93
PHP	115	59	123	100	160	78

How to Read an Index:

An index is a way to compare relative differences among different segments of data. 100 = Overall rating. >100 = Represents interest greater than the overall. The higher the number, the greater the interest relative to the overall score. <100 = Represents interest lower than the overall. The lower the number, the lower the interest relative to the overall score. A score of 90 means the respondent is 10% less likely than the average to rate the IT skill as important. Conversely, a score of 110 means the respondent is 10% more likely than average to rate the IT skill as important. It's important to note, a high score only means there is a strong rating relative to the other segments. A score could be relatively high, but overall importance could be relatively low.

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IT Skills Gaps Concerns

In many areas, firms operating in the IT industry vertical and firms operating in all other industry verticals share many of the same concerns over IT skills gaps. The core functions of information management, network infrastructure, security and data storage rate as top level areas of concern, where current or future skill sets are not at desired levels.

Help desk and IT support also rate as concerns. While the methods of providing IT support have evolved (think remote maintenance and monitoring) and the range of devices, locations and workers using technology have expanded, there continues to be a fundamental need for IT support services. For IT companies this may entail providing support to customers, while for companies in other verticals it may be the help desk function within the IT department.

The results indicate IT industry firms express slightly more concern over cloud computing skills gaps in the areas of infrastructure-as-a-service (IaaS) and platform-as-a-service (PaaS). This is likely driven by competitive pressures – many IT firms are scrambling to build and promote their cloud-based service offerings. Obviously, inadequate levels of expertise will hamper those efforts.

Skills Gaps Concerns Among IT Industry Firms

- Database / Information management
- Networks / Infrastructure
- Server / data center management
- Security / Cybersecurity
- Help Desk / IT support
- Data analytics / Business intelligence
- Web design / development
- Application development / programming
- Virtualization
- Storage / data back-up
- Cloud computing - IaaS or PaaS

Skills Gaps Concerns Among Firms in Other Industry Verticals

- Security / Cybersecurity
- Networks / Infrastructure
- Database / Information management
- Server / data center management
- Storage / data back-up
- Web design / development
- Help Desk / IT support
- Data analytics / Business intelligence
- Virtualization
- Enterprise resource planning (ERP)
- Customer relationship management (CRM)

Again, it's worth noting, low concern over a skills gap doesn't automatically mean the skill is unimportant or there is already an optimal pool of workers with the desired levels of knowledge and skill sets. Rather, it may be a reflection of where the technology is in its lifecycle. For example, the reason relatively few respondents express concern over skills gaps in big data or mobile app development may be because relatively few firms are far enough along in to have an understanding of skills needs.

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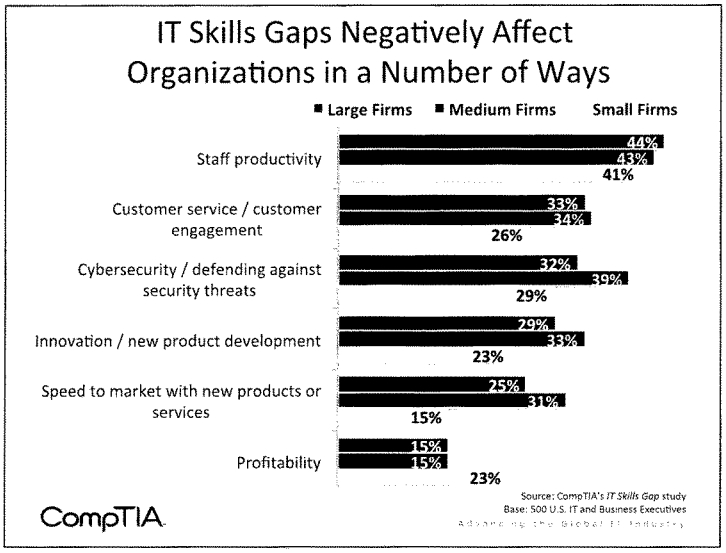
As implied earlier, a company's shortfall in IT skills is likely to impede on other areas of the business. While it would be difficult to measure direct costs or opportunity costs, a large majority (80%) of employers point to at least one specific business area potentially affected by their organization's IT skills gap.

Top areas influenced by shortcomings in IT skills are staff productivity (41%), customer service / customer engagement (32%), and security (31%). It especially affects speed to market for IT businesses (34%) versus those in other industries (20%). Also interesting to note, smaller companies feel the punch in profitability more so than larger firms.



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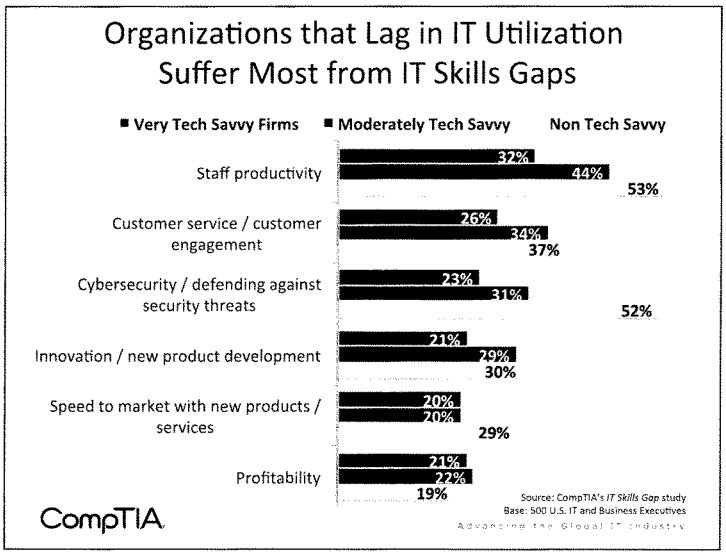
Additionally, the data validates that the companies significantly more likely to be negatively impacted by their IT skills gaps are the ones not close to where they want to be in using technology, i.e. "non tech savvy." As the chart below shows, the more "tech savvy" a firm is, the less of an impact their IT skills gaps have on business areas such as productivity, customer service, and security. This also holds true for the level of IT skills. The further away a firm's staff IT skills are from their organization's ideal, the larger the negative impact on other business areas. Hence, to reiterate the point made in Section 1, even modest improvements in the two areas of technology utilization and staff skill levels would likely yield massive economic benefits.



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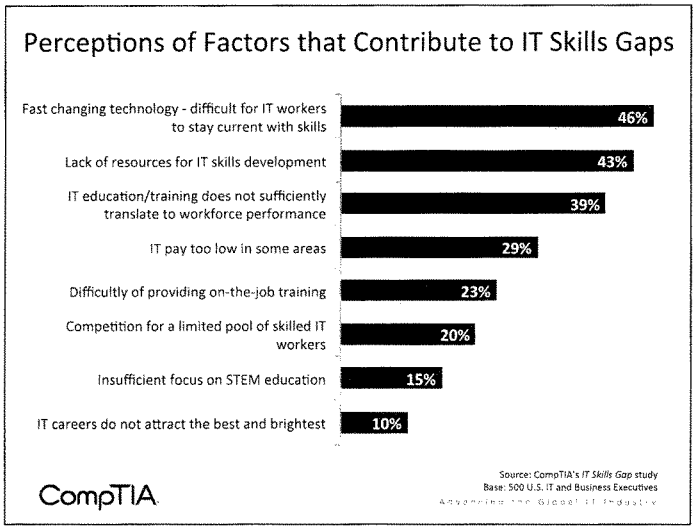
Many Factors Contribute to IT Skills Gaps

The research confirms most organizations recognize the presence of IT skills gaps and their potential harm to the bottom line, and yet, a plurality of firms acknowledge the need for improvement. The research helps explain this apparent disconnect. Simply put, there are many factors driving IT skills gap and few easy answers.

Overall, the greatest percentage of respondents cite the dynamic nature of the tech space as a primary cause of skills gaps. Innovation occurs faster and on more fronts, product lifecycles are now measured in months instead of years and market competition has never been greater. Consequently, organizations and IT staff are put in the difficult position of having to decide where to invest their limited time. A hedging approach whereby IT teams seek basic knowledge about a lot of technologies prevents organizations from becoming true experts in any one domain. Conversely, a focused approach exposes organizations to the risk of picking the wrong technologies and/or strategies.

The two other prominent factors are resource constraints and a perceived lack of workplace improvement following education or training. There are unique elements to these two issues, but also areas of overlap. Lack of resources is another way of saying the expenditure is a low priority or the perceived ROI is low. Similarly, concerns that IT education and training does not sufficiently translate to workplace performance is really another way of saying the ROI of education and training is too low.

While these concerns are certainly valid in some cases, more often than not, organizations struggle to measure and understand staff productivity, the value of time and the ROI of training. Without the proper metrics in place and the knowledge to use them, organizations will be ill-equipped to strategically overcome IT skills gaps (more on this topic in Section 3 of this report).



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Summary Points of Contributing Factors to IT Skills Gaps by Segment:

Larger Firms

- Relatively more concerned about fast changing technology, insufficient transfer of education/training to workplace performance, competition for a limited pool of skilled IT workers

Smaller Firms

- Relatively more concerned about lack of resources for education/training

IT industry Firms

- Relatively more concerned about insufficient transfer of education/training to workplace performance, competition for a limited pool of skilled IT workers, insufficient focus on STEM education and IT careers not attracting the best and brightest

Non-IT industry Firms

- Relatively more concerned about lack of resources for education/training

Perceptions of Factors that Contribute to IT Skills Gaps

	Micro Firms	Small Firms	Medium Firms	Large Firms	IT Industry Firms	Non-IT Industry Firms
Fast changing technology - difficult for IT workers to stay current with skills	39%	49%	49%	48%	48%	45%
Lack of resources for IT skills development	45%	48%	39%	41%	38%	45%
IT education/training does not sufficiently translate to IT workforce performance	31%	35%	48%	44%	45%	36%
IT pay is too low in some areas	20%	33%	35%	28%	31%	28%
Difficult to conduct on-the-job training for IT workers	20%	25%	26%	20%	25%	22%
Competition for a limited pool of skilled IT workers	16%	16%	22%	25%	26%	17%
Insufficient focus on STEM education	16%	16%	15%	14%	25%	12%
IT careers do not attract the best and brightest workers	10%	4%	12%	12%	16%	7%

Source: CompTIA's *IT Skills Gap* study
Base: 500 U.S. IT and Business Executives

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STATE OF THE IT SKILLS GAP

SECTION 3: ADDRESSING IT SKILLS GAPS

FEBRUARY 2012

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Section 3 – Key Points

- More than half (56%) of employers do not have a process or method for identifying possible IT skills gaps among employees.
- About 4 in 10 (39%) IT and business managers believe that their executive management and HR do not give enough attention to IT skills gap issues.
- Nearly 6 in 10 (57%) organizations address IT skills gap challenges via training or retraining existing staff in areas where skills are lacking.
- The most common training method companies use for IT staff professional development is online self-study.

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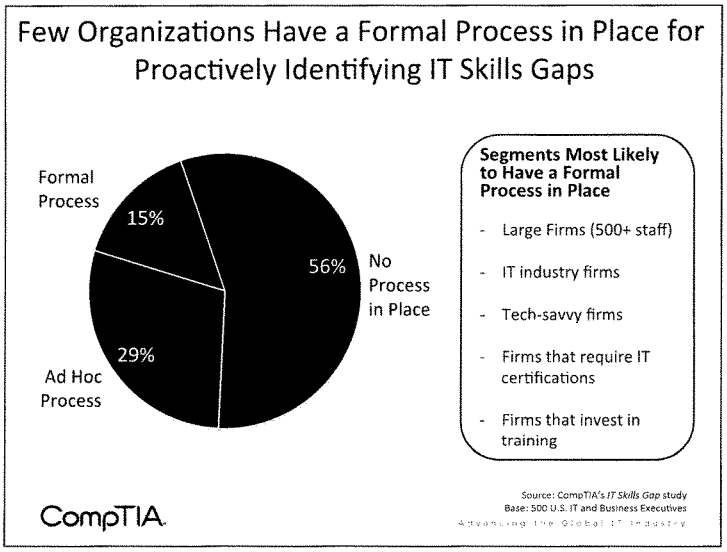
Most Organizations Reactive in Their IT Skills Gaps Strategies

Given the apparent scope of IT skills gaps and the impact on other areas of business, it's somewhat surprising that most organizations do not have a process or method for identifying possible IT skills gaps among employees. Related to findings in Section 2, companies struggle with a lack of resources for IT skills development.

Additionally, employers likely find it challenging to implement the framework to shift to a more proactive or formal process for at least discovering skills gaps. Or they may simply be unaware of the possible human capital or workforce management type of resources they could use. This points to an opportunity for IT firms to work with these organizations on appropriate solutions, showcasing the ROI of employee training as well.



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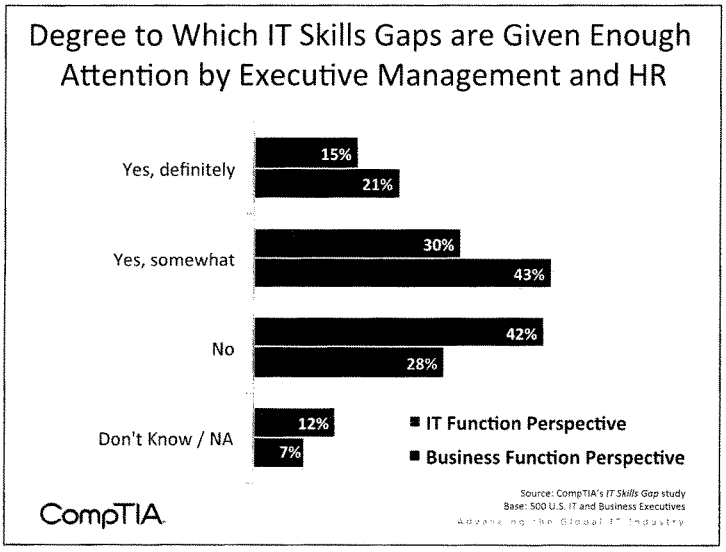
Even if a firm recognizes IT skills gaps among its employees, not much can be resolved without the necessary support from executives and expertise from human resources. According to the data recently collected, clearly efforts are concentrated elsewhere when employers should try to focus more on their employees; their most valuable asset after all. Those in IT management roles are especially feeling the neglect. On the other hand, findings suggest that executives and HR professionals in IT firms are more attentive to IT skills gaps than companies outside of the IT industry.

Respondents cite a variety of reasons for why executive management and HR do not give IT skills gap issues enough attention. Common themes emerge around IT not being a priority (until something breaks), lack of budget/resources, the "cost" of training, and the lack of technical knowledge. Sampling of verbatim comments:

- *"Their priority is with other areas. They don't recognize the importance of IT as it relates to overall strategy."*
- *"Funding and resources. Budget restraints are the number one issue!"*
- *"They do not understand the amount of time necessary to stay abreast of current IT trends and learning new skills."*
- *"Most do not realize or accept all the background challenges and maintenance actions that occur. They only see the finished product or higher level and higher visibility results without realizing all the background actions that were needed to have it occur."*



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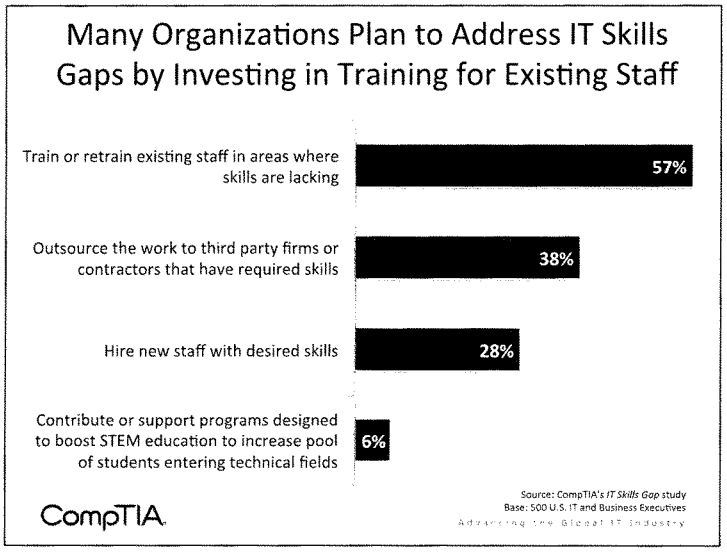
Training Existing Staff Key

The primary way organizations address IT skills gaps challenges is via training existing staff versus turning elsewhere for new workers. Most professionals in executive or HR roles should already recognize that investing in staff training is typically a cheaper option than hiring new employees or outsourcing.

As CompTIA's *Employer Perceptions of IT Training and Certification* study highlights, there is a wide spectrum of professional development support organizations actually provide to employees. Nevertheless, nearly two-thirds view professional development as either extremely important (20%) or very important (45%). Another 28% declare it is moderately important. Interestingly, perhaps because of available resources or advancement opportunities, large-size companies place significantly higher importance on professional development than small-size firms.



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It makes sense that the firms more likely to train current employees are larger or in the IT industry. Conversely, the organizations more likely to outsource are micro-size. Therefore, as companies increasingly adopt emerging technologies and look to advance their skills support, IT service providers may want to first target selling to organizations with just 5-24 employees.

Addressing IT Skills Gaps by Segment

	Micro Firms	Small Firms	Medium Firms	Large Firms	IT Industry Firms	Non-IT Industry Firms
Train or retrain existing staff in areas where skills are lacking	49%	50%	64%	70%	72%	52%
Hire new staff with desired skills	22%	26%	25%	45%	38%	25%
Outsource the work to third party firms or contractors that have required skills	48%	39%	30%	33%	26%	43%
Contribute or support programs designed to boost STEM education to increase pool of students entering technical fields	9%	4%	8%	5%	12%	5%

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Source: CompTIA's *IT Skills Gap* study
Base: 500 U.S. IT and Business Executives
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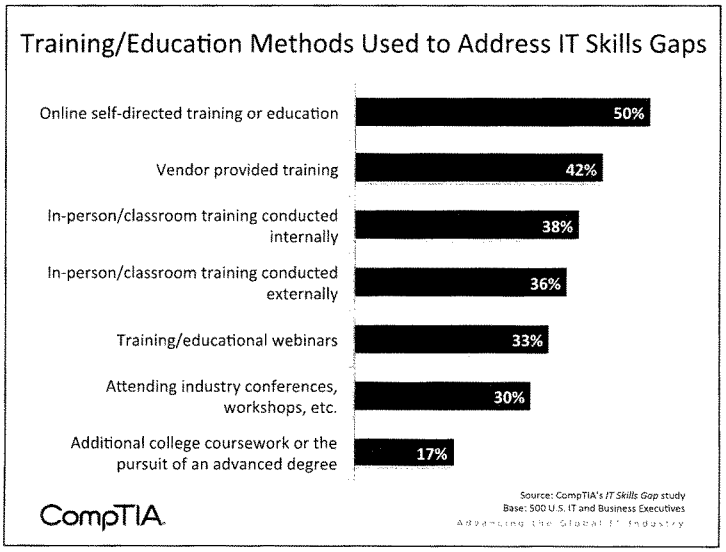
The American Society for Training and Development (ASTD) estimates U.S. organizations spent $125.88 billion on employee learning and development in 2009. Note: this figure includes expenditures on things such as operations, trainer salaries, and administrative costs. Nearly two-thirds of the US total ($78.6 billion) was spent on the internal learning function, such as staff salaries and internal development costs, with the remainder ($47.3 billion) allocated to external services such as workshops, vendors and external training sessions.

A growing piece of the training/education market is eLearning. As reflected in CompTIA's recent study, online self-study is the primary method companies use for addressing IT skills gap challenges. However, other types of training such as vendor-provided and instructor-led classroom are popular as well.



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Factors such as company size and type of business may affect an organization's likelihood to use one type of training method over another. For example, large-size organizations are more likely to utilize nearly all the different methods covered in this study versus their smaller counterparts. IT workforce training providers may do well to primarily target the larger firms (500 or more employees), especially for vendor-provided training, classroom training, or industry conferences/workshops.

Training/Education Methods Used by Segment

	Micro Firms	Small Firms	Medium Firms	Large Firms	IT Industry Firms	Non-IT Industry Firms
Online self-directed training or education	45%	49%	53%	54%	60%	46%
Vendor provided training	36%	39%	45%	50%	48%	39%
In-person/classroom training conducted internally	38%	35%	34%	47%	59%	31%
In-person/classroom training conducted externally	32%	29%	38%	49%	37%	36%
Training/educational webinars	34%	29%	36%	31%	42%	29%
Attending industry conferences, workshops	25%	27%	33%	40%	36%	28%
Additional college coursework or the pursuit of an advanced degree	10%	16%	20%	24%	24%	14%

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